Environmental Assessment

WATERFOWL DAMAGE MANAGEMENT IN PENNSYLVANIA

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Animal and Plant Health Inspection Service
Wildlife Services

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LIST OF ACRONYMS

AAWV	American Association of Wildlife Veterinarians
AC	Apha chloralose
AF	Atlantic Flyway
AFC	Atlantic Flyway Council
AP	Atlantic Population
APHIS	Animal Plant Health Inspection Service
BCC	Biological Carrying Capacity
BPI	Breeding Plot Index
CEQ	Council of Environmental Quality
CFR	Codes of Federal Regulation
DCNR	Department of Conservation of Natural Resources
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FDA	U.S. Food and Drug Association
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
INAD	Investigational New Animal Drug
IPM	Integrated Pest Management
IWDM	Integrated Wildlife Damage Management
NEPA	National Environmental Policy Act
NHPA	The National Historic Preservation Act
MBTA	Migratory Bird Treaty Act
MIS	Management Information System
MWS	Mid-winter Waterfowl Survey
NOA	Notice of Availability
PGC	Pennsylvania Game Commission
T&E	Threatened and Endangered Species
USFWS	U.S. Department of Interior, Fish and Wildlife Service
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WAC	Wildlife Acceptance Capacity
WEMP	Waterfowl Ecology and Management Program
WS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services

1.0 CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The United States Department of Agriculture (USDA) is authorized to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Service (WS) program is the Act of March 2, 1931, as amended (7 U.S. C. 426426c; 46 Stat. 1468) and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c), and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001, Public Law 106-387, October 28, 2000. Stat. 1549 (Sec 767) WS activities are conducted in cooperation with other federal, state and local agencies, and private organizations and individuals. Federal agencies, including the United States Department of Interior, United States Fish and Wildlife Service (USFWS), recognize the expertise of WS to address wildlife damage issues related to migratory birds.

Wildlife damage management is defined as the alleviation of damage or other problems caused by or related to the presence of wildlife, and it is an integral component of wildlife management (Leopold 1933, the Wildlife Society 1990, Berryman 1991). The WS program uses an Integrated Wildlife Damage Management (IWDM) approach (similar to Integrated Pest Management or IPM) in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of the Animal Damage Control Program Final Environmental Impact Statement (USDA 1997). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The reduction of wildlife damage may also require that the offending animal(s) be removed or that populations of the offending species be reduced through lethal methods.

WS's mission is to "provide federal leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety." This is accomplished through:

A) training of wildlife damage management professionals;
B) development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
C) collection, evaluation, and dissemination of management information;
D) cooperative wildlife damage management programs;
E) informing and educating the public on how to reduce wildlife damage and;
F) providing data and a source for limited use management materials and equipment, including pesticides (USDA 1989).

This environmental assessment (EA) evaluates ways by which this responsibility can be conducted to resolve damage and conflicts associated with Canada geese (*Branta canadensis*), mallard ducks (*Anas platyrhynchos*), mute swans (*Cygnus olor*) and domestic or feral waterfowl in Pennsylvania. WS strives to reach and maintain a balance between wildlife needs and welfare and human needs and welfare. Humans and waterfowl are both part of the environment and both sets of needs and welfare must be considered when selecting methods and approaches to be used in a waterfowl damage management program. WS conducts wildlife damage management as a

means of reducing damage, not in order to punish offending animals, to treat them inhumanely or abuse their welfare.

WS is a cooperatively funded and service oriented program. Before any operational wildlife damage management is conducted, *Agreements for Control* or *WS Work Plans* are completed by WS and the land owner/administrator. WS cooperates with private property owners and managers and with agencies, as requested and appropriate, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with federal, state, and local laws, regulations, policies, orders, and procedures including the Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA).

Most individual actions of the types encompassed by this analysis could be categorically excluded under the APHIS (Animal and Plant Health Inspection Service) Implementing Regulations for compliance with the National Environmental Policy Act (NEPA) (7 CFR§372.5(c)). APHIS Implementing Regulations also provide that all technical assistance furnished by WS is categorically excluded (7 CFR§372.5(c)) (60 Federal Register 6,000, 6,003 (1995)). However, WS is preparing this EA to assist in planning waterfowl damage management activities and to clearly communicate with the public the analysis of cumulative impacts of issues of concern in relation to alternative means of meeting needs for such management in Pennsylvania. This analysis covers current and future waterfowl damage management activities by WS wherever and whenever they might be requested, in all 67 counties in Pennsylvania.

This EA documents the analysis of the potential environmental effects of the proposed program. This analysis relies mainly on existing data contained in published documents (Appendix A), and on the Animal Damage Control Final Environmental Impact Statement (USDA 1997) to which this EA is tiered.

1.2 PURPOSE

The purpose of this EA is to analyze the effects of WS activities in Pennsylvania to reduce damage associated with Canada geese, mallard ducks, mute swans, and domestic or feral waterfowl. Resources potentially protected by such activities include property, agriculture, natural resources, quality of life, human health, and human safety.

1.2.1 Summary of Proposed Action

The proposed action is for WS to continue to implement an Integrated Waterfowl Damage Management Program that responds to requests for the protection of property, agricultural resources, natural resources, quality of life, human health, and human safety in Pennsylvania. Requests for assistance may occur anywhere and anytime within the state. The program would include the use of legal techniques and methods, used singly or in combination, to meet requester needs for reducing conflicts with waterfowl (Appendix B). Cooperators requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Non-lethal methods recommended and used by WS may include resource management, physical exclusion, relocation, and deterrents (Appendix B). Lethal methods recommended and used by WS may include nest/egg destruction, live capture and transportation to an approved poultry processing facility, live capture and euthanasia, and/or shooting (Appendix B). In many situations, the implementation of non-lethal methods such as

manipulation of habitat, application of repellents, and installation of fencing, flagging, and exclusion devices would be conducted by the requestor. Wildlife damage management assistance regarding waterfowl would be conducted by WS in Pennsylvania, when requested, on private and public property and facilities where a need exists and pursuant to an *Agreement for Control*.

The proposed Program conducted by WS in PA would continue to be conducted pursuant to applicable laws and regulations authorizing take of waterfowl and their nest and eggs, developed through partnerships among WS, the U.S. Fish and Wildlife Service (USFWS), and the Pennsylvania Game Commission (PGC), and as requested by and through coordination with requesters of assistance. All management actions would comply with appropriate federal, state, and local laws.

1.3 NEED FOR ACTION

Wildlife management is often perceived as the struggle to preserve threatened and endangered (T & E) species, regulate species exploited by humans and the humans who exploit them, and conserve the landscape that provides habitat for wildlife resources. Increasingly, however, cities, towns, parks, airports, and private properties have become sites of some of the greatest challenges for wildlife management. When the presence of prolific adaptable species such as Canada geese, mallard ducks, mute swans, and domestic or feral waterfowl is combined with human interest in seeing and being close to wildlife, conflicts often develop. Long thought of as a spectacular sight during the spring and fall migration, waterfowl are now frequently and abundantly present in cities and towns throughout Pennsylvania and across the United States. They are generally regarded as providing ecological, educational, economic, recreational, and aesthetic benefits (Decker and Goff 1987), and there is enjoyment in knowing wildlife exists and contributes to natural ecosystems (Bishop 1987). Waterfowl, like all wildlife, provide people with valued contact with nature. They contribute to the quality of life in Pennsylvania. Many people, even those experiencing damage, consider waterfowl to be a charismatic and valuable component of their environment. However, tolerance of waterfowl behavior differs among people (Smith et al. 1999). Because of their prolific nature, site tenacity, longevity, size, and tolerance of human activity, waterfowl are often associated with problem situations. Increasing populations of resident waterfowl are resulting in increasing numbers of conflicts with human activities (Conover and Chasko 1985), and increasing concerns related to human health and safety (Ankney 1996). Because they can fly, waterfowl are mobile, they exploit a variety of habitats and sites within a given area, and they cannot be permanently excluded from large areas. Additionally, management of waterfowl-related problems often exceeds the capabilities of single landowners to reduce damage to tolerable levels. In Pennsylvania, problem situations associated with waterfowl typically involve, but are not limited to, unacceptable and potentially dangerous accumulations of feces, waterfowl aggression during the nesting season, grazing of landscaped vegetation, damage to agricultural and natural resources, and unacceptable safety hazards for vehicles (automobiles, boats, airplanes). These problems frequently occur on private home properties, apartment/condominium complexes, municipal parks, schools, hospitals, natural/habitat restoration sites, corporate and industrial sites, office complexes, roadways, airports, and other areas.

1.3.1 Wildlife Acceptance Capacity (WAC) and Biological Carrying Capacity (BCC)

Human dimensions of wildlife management include identifying how people are affected by problems or conflicts with wildlife, attempting to understand people's reactions, and incorporating this information into policy and management decision making processes and programs (Decker and Chase 1997).

Wildlife Acceptance Capacity (WAC), sometimes known as cultural carrying capacity, is the maximum wildlife population level in an area that is acceptable to people (Decker and Purdy 1988). This phrase is important because it defines the sensitivities of the local community to a specific wildlife species or problem. For wildlife damage situations, there will be varying thresholds for those people directly and indirectly affected by the damage. This threshold of damage is a primary limiting factor in determining the WAC. Once this WAC is met or exceeded, people seek to implement waterfowl population reduction methods to alleviate property damage and threats to quality of life, human health or safety.

Biological Carrying Capacity (BCC) is the wildlife population level that the land or habitat can support without degradation to the populations health, animals' health or the environment over an extended period of time (Decker and Purdy 1988). While the biological carrying capacity for waterfowl in Pennsylvania may be greater than the statewide population, the WAC is probably lower.

1.3.2 Waterfowl In Pennsylvania

There are two behaviorally distinct types of Canada goose populations: Resident and Migratory. Currently, in PA, there are an estimated 234,754 total resident Canada geese (PGC 2002). Pennsylvania consists of two migratory bird populations; the Atlantic Population and the Southern James Bay Population are present in certain areas of Pennsylvania during migration and winter periods. The 2002 population estimate for the Atlantic population was 164,800 breeding pairs (PGC 2002). The 2002 population estimate for the Southern James Bay Population was 76,300 (PGC 2002). The 2002 population estimate for mallards, in Pennsylvania, was 84,534 pairs. The NE Atlantic Flyway (from VA to ME) estimate for mallards was 834,059 (+/-) 56,247 in 2002 (Person. Comm., J. Dunn, PGC, December, 2002). In 2002, the statewide mute swan population was estimated at 348 individuals (Person. Comm., J. Dunn, PGC, December, 2002). There is no population estimate for domestic or feral waterfowl in Pennsylvania (Person. Comm., J. Dunn, PGC, December, 2002).

The population goal for resident Canada geese in Pennsylvania is 100,000 geese, or about 2.2 birds per square mile (Atlantic Flyway Council 1999). The population goal for mallards in Pennsylvania is 78,000 breeding pairs (Person. Comm., J. Dunn, PGC, December, 2002). There is no population objective for domestic or feral waterfowl in Pennsylvania. Biologically, the optimum mute swan population size for Pennsylvania is zero. Therefore, on state, federal, and other public lands the goal is zero mute swans (Person. Comm., J. Dunn, PGC, December, 2002). However, to accommodate sociological preferences for the presence of some mute swans, the goal for the rest of the state is to avoid any further population growth and maintain the total

statewide population at a maximum of 250 birds (Person. Comm., J. Dunn, PGC, December, 2002).

1.3.2.1 Ecology, Behavior and Population Status

1.3.2.1.1 Resident Canada Geese

A resident Canada goose is one that nests and/or resides on a year round basis within the contiguous United States (Rusch et al. 1995, Ankney 1996). More specifically, the Atlantic Flyway Council defines a "resident" Canada goose in the Atlantic Flyway as geese that are hatched or nest in any Atlantic Flyway state, or in Canada at or below 48^0 N latitude and east of 80^0 W longitude, excluding Newfoundland. This population inhabits the states along the U.S. Atlantic Coast, southern Quebec, and the southern Maritime Provinces of Canada (U.S. Fish and Wildlife Service 2001). As their name implies, resident Canada geese spend most of the year near their breeding areas, although many in northern latitudes do make seasonal movements (Atlantic Flyway Council 1999). Resident Canada geese were introduced into the Atlantic Flyway during the early 1900's and now comprise the largest population of geese in the Flyway, with an estimated 1.1 million birds in spring (Atlantic Flyway Council 1999). The three most common subspecies of Canada geese in Pennsylvania are the Atlantic (*B.c. canadensis*), the Interior *(B.c. interior*), and the Giant Canada goose (*B.c.maxima*). Annual estimates of the Atlantic Flyway resident Canada goose population have increased an average of 8% per year since 1991 (USFWS 2001).

Resident Canada geese become sexually mature and breed at two or three years of age and have a relatively high nesting success compared to migrant Canada geese (U.S. Fish and Wildlife Service 2001). Breeding resident Canada geese occur in every county of PA, and nest primarily during March-May each year. The breeding population is monitored annually through the Breeding Waterfowl Survey. In Pennsylvania, resident Canada geese nest in traditional sites (along shorelines, on islands and peninsulas), as well as on rooftops, adjacent to roadways, swimming pools, and in parking lots, playgrounds, planters, and abandoned property (tires, automobiles, etc.).

Molting is the process whereby geese annually replace their primary and secondary flight (wing) feathers (Welty 1982). In PA, resident Canada geese molt, and are flightless, from mid-June through mid-July each year. Portions of a flock of geese can be flightless from about one week before and two weeks after the primary molt period due to the asynchronous molting by individual birds. Nonbreeding resident Canada geese and geese which have failed nesting attempts sometimes move to other areas in late spring prior to molting (Zicus 1981, Nelson and Oetting 1991, Abraham et al. 1999).

The first management plans for Canada geese were developed in 1989, when it became apparent that they were contributing significantly to sport harvests and human/goose conflicts. Resident geese are now the most numerous goose population in the flyway, and in 1999 the Atlantic Flyway Council approved a management plan to guide their management (Atlantic Flyway

Council 1999). However, the Atlantic Flyway population of resident has been statistically stable since 1997 (PGC 2001).

The Pennsylvania statewide total resident Canada goose population for 2002 was estimated at 234,754; which is similar to the 10 year average (193,266) and the 2001 estimate (246,859) (PGC 2002). The number of goose breeding pairs in Pennsylvania in spring 2002 was 85,192; which was similar to the 1992-2001 average (84,049 pairs) (Table 1) (PGC 2002). Canada goose pairs are most abundant in the northwest (1.49 pairs/km2) and southeast (1.43 pairs/km2) sections of the State (PGC 2002). The type of waterfowl population objective, which applies to resident Canada geese, is "optimum". This means that waterfowl biologists do not want to population size to fall too far below or go too far above the population objective (PGC 2002). As specified by the Pennsylvania Game Commission, the population objective for Pennsylvania is about 100,000 geese or about 2.2 per square mile (Atlantic Flyway Council 1999). This population level is similar to the state wide estimates during the early 1990s before regular Canada goose hunting seasons were suspended and the population levels began to increase dramatically (population growth rates were the highest from the late 1980's to mid 1990's before special resident goose seasons were widely established). This number is thought to provide optimal recreational opportunities while reducing nuisance and damage complaints.

Table 1. Number of resident Canada goose pairs and total number of resident Canada geese in Pennsylvania.

Year	Number of Resident Canada Goose Pairs	Total Number of Resident Canada Geese
1994	57,203	150,608
1995	81,056	206,192
1996	71,120	189,860
1997	87,849	194,607
1998	88,975	196,661
1999	104,343	261,965
2000	85,379	225,472
2001	96,468	246,859
2002	85,192	234,754

Five Management Objectives are identified in the Atlantic Flyway Resident Canada Goose Management Plan (Atlantic Flyway Council 1999):

A. Reduce resident Canada goose populations in the Atlantic Flyway (AF) to 650,000 birds (spring estimate) by 2005, distributed in accordance with levels prescribed by

individual states and provinces.

B. Permit a wide variety of effective and efficient options for relief of damage and conflicts associated with resident Canada geese.
C. Provide maximum opportunities for use and appreciation of resident Canada geese, consistent with population goals.
D. Ensure compatibility of resident goose management with management of migrant goose populations in the AF, and vice versa.
E. Annually monitor populations, harvest, and damage/conflict levels to evaluate effectiveness of management options.

1.3.2.1.2 Migratory Canada Geese

Migratory Canada geese are those which nest and raise their young in the arctic and sub-arctic regions of Canada. Migrant geese begin moving north in time to arrive on their breeding grounds concurrent with the disappearance of ice cover and the availability of nest sites. Migrant geese arrive on the breeding grounds from early May on James Bay and late April for Hudson Bay (Malecki, R.A, BDJ Batt and S.E. Sheaffer 2001). Most subspecies of migratory geese do not nest until the ages of 3-5 years (Hardy and Tacha 1989, Moser and Rusch 1989, Rusch et al.1996). Migrating Canada geese move northward fairly gradually following the retreating snow cover (Bellrose 1980). For the last portion of migration, northern-nesting geese often over fly areas of snow in boreal forests to arrive on Arctic and Subarctic nesting areas just as spring breaks. The most southerly wintering geese leave their wintering areas in January and geese wintering at middle-latitudes move northward in March or April (Bellrose 1980).

Two distinct populations of migratory geese are present during part of the year in Pennsylvania, the Atlantic population and the Southern James Bay population (PGC 2001). The Atlantic populations of Canada geese nest across a broad area of northern Quebec, with the highest densities in the Ungava Peninsula along the Hudson Bay in the west and Ungava Bay in the east (PGC 2001). In 2002, the estimated number of breeding pairs for the Atlantic population of migratory geese was estimated to a new recorded high of 164,800 breeding pairs, 12% above the 2001 estimates and 10% above the population objective of 150,000 (PGC 2002). The Southern James Bay population of Canada geese nests on the Akimiski Island, Nunavut and in the James Bay lowlands of Ontario. This population of geese is the predominant migratory goose population in northwest Pennsylvania (PGC 2001). The 2002 spring population was estimated at 76,300, 26% lower than in 2001. Nest success was the lowest recorded since 1993 (PGC 2002).

1.3.2.1.3 Mallard Ducks

The mallard is Pennsylvania's most abundant and widespread breeding species of duck (Hartman 1992). Mallards occur across the continent in every U.S. state and Canadian province (Bellrose 1976). Mallards are most common in farmlands with numerous ponds, lakes, and slowly flowing streams; in areas with extensive or numerous marshes near grasslands; and in idle and brushy areas dotted with ponds and laced with meandering streams (Hartman 1992). Like geese, mallards are also found in urban and suburban areas such as parks, golf courses, natural wetlands, retention ponds and lakes, housing complexes, and industrial parks. Mallards breed in all 67 counties in Pennsylvania and begin their breeding season in late March and early April;

with most nesting occurring from mid-April through mid to late May. Renesting occurs into early July (Hartman 1992). Mallards breed readily with American black ducks and domestic ducks. The offspring of the cross with domestics may resemble the mallard, but their markings and coloration are noticeably different. Mallard-black duck hybrids are considered to be wild ducks; evidence suggests that the two are closely related (Hartman 1992).

In 2002, the mallard population for the NE Atlantic Flyway was estimated at 834,059. The Pennsylvania statewide total for 2002 was estimated at 171,752, which is lower than the 10 year average of 218,518 and less than the 2001 estimates of 189,711. The number of breeding pairs in Pennsylvania in 2002 was 84,534, similar to the 10 year average of 100,600 and less than the 2001 estimates of 89,030 (Table 2). The type of waterfowl population objective, which applies to wild mallards, is "minimum". This means that waterfowl biologists consider a population size above the population goal to be better than being below the population goal. The population goal for mallards is 78,000 breeding pairs in Pennsylvania (PGC 1997).

Table 2. Number of mallard duck pairs and total number of mallard ducks in Pennsylvania.

Year	Number of Mallard Pairs	Total Number of Mallards
1994	134,065	275,822
1995	123,174	264,480
1996	108,731	220,148
1997	109,767	223,017
1998	92,453	191,082
1999	121,515	246,359
2000	88,443	185,318
2001	89,030	189,711
2002	84,534	171,752

1.3.2.1.4 Mute Swans

Mute swans are not native to North America, having been introduced from Europe in the 1800's. Feral populations became established over time as swans that had escaped or been intentionally released from captivity survived and reproduced in the wild. Mute swans prefer freshwater ponds and streams of 10 acres or less and coastal bays and salt marshes. Eastern birds migrate short distances to coastal bays for the winter. The swan's diet consists mostly of rooted aquatic vegetation. Small islands, narrow peninsulas, and clumps of aquatic vegetation are preferred nesting sites. Nesting territories vary in size from 4 to 10 acres and are used year-around or reoccupied each year. The mute swan lays the largest of all swan eggs, and a typical clutch of four to eight eggs takes 35 to 38 days to hatch.

Since 1986, the Atlantic Flyway population of feral mute swans has grown 118%, from 5,800 birds to over 12,600 swans. This growth is seen throughout the Flyway, especially in the Chesapeake Bay region (Maryland and Virginia) which has increased 1271.3%. This rapid growth rate in the Chesapeake Bay shows the potential growth rate that this invasive species could have throughout the Flyway. The upper Mid-Atlantic States of New York, New Jersey, and Pennsylvania had a combined mute swan growth rate of 62.4%. Pennsylvania, in itself, only had an 8% increase. At present, most mute swan sightings have been in the southeast region of Pennsylvania and include mostly domestic birds in private ponds. These swans are a potential nucleus for a future feral population (Atlantic Flyway Council 2000). During the 13-year period of surveys, the population has annually contained between 9.8 and 12% young of the year, with a period average of 11.3%. The ratio of cygnets/brood during 1999 (3.4) is similar to the 13-year average. Assuming the average clutch size for mute swans is 6.2 eggs, then the average 3.3 cygnets per brood nearing flight stage indicates a possible annual first year survival rate of 53.2% (Atlantic Flyway Council 2000).

According to Pennsylvania's Mute Swan Mid-summer Survey, conducted in 2002, 348 mute swans were observed (289 adults and 59 cygnets) (PGC 2002). These numbers were similar (38% higher) to the 253 swans observed in 1996 (44% higher than the 242 observed in 1999, although the number classified as feral has remained stable around 100 birds since the early 1990's). Twenty-four broods were observed in 2002, up from 19 in 1999 (Table 3). As in 1996 and 1999, the greatest numbers of mute swans were observed in the Southeast Region of Pennsylvania with 161 birds in 2002. The type of waterfowl population objective, which applies to mute swans, is "maximum". This means that waterfowl biologists consider a population size below the population goal to be better than being above the population goal.

Table 3. Numbers of mute swans for 2002 in Pennsylvania (by region).

Region	Number of Adults	Number of Broods	Number of Cygnets	Total Swans	Number Swans Assumed Wild
NW	91	5	12	103	5
SW	9	0	0	9	4
NC	15	0	0	15	0
SC	19	2	4	23	4
NE	28	5	9	37	12
SE	127	12	34	161	69
State Total	**289**	**24**	**59**	**348**	**94**

1.3.2.1.5 Domestic and Feral Waterfowl

Many waterfowl of domestic or semi-wild genetic backgrounds have been released by humans into rural and urban environments; including numerous species of ducks, geese, and swans. Selective breeding has resulted in the development of numerous domestic varieties of the mallard ducks that no longer exhibit the external characteristics or coloration of their wild mallard ancestors. Examples of domestic or feral waterfowl include but are not limited to Muscovy ducks, Pekin ducks, Rouen ducks, Cayuga ducks, Swedish ducks, Chinese geese, and Toulouse geese. Federal law protects all migratory birds, except domestic varieties of waterfowl (Title 50,

Code of Federal Regulations, Part 21). Domestic and Feral waterfowl in Pennsylvania may be of mixed heritage and may show feather coloration of wild waterfowl. Some domestic and feral ducks are incapable of sustained flight, while some are incapable of flight at all due to hybridization. Domestic waterfowl may at times cross breed with migratory waterfowl species creating a hybrid cross breed (i.e. mallard X domestic duck, Canada goose X domestic goose). These types of hybrid waterfowl species will be taken in accordance definitions and regulations provided in CFR 50 Part 10 and 21.

An example of a feral duck is the "urban" mallard duck. The coloration of the feathers of urban ducks is highly variable and often does not resemble that of the wild mallard ducks. Urban mallard ducks in Pennsylvania often display the following physical characteristics: male may be missing the white neck ring or the neck ring will be an inch wide instead of the narrower 1/4 inch wide ring found on wild mallards, males may have purple heads instead of green heads, females may be blond instead of mottled brown, the bills of females may be small and black instead of orange mottled with black, either sex may have white coloration on the wings, tail, or body feathers, and ducks may weigh more than wild ducks (2.5-3.5 pounds).

Domestic waterfowl have been purchased and released by property owners for their aesthetic value, but may not always remain at the release sites, thereby becoming feral. Feral waterfowl is defined as a domestic species of waterfowl that can not be linked to a specific ownership. Waterfowl releases are made in business parks, universities, wildlife management areas, parks, military bases, and housing developments. Many times, these birds are released with no regard or understanding of the consequences or problems they can cause to the environment or the local community.

There are no population estimates, in Pennsylvania, for domestic or feral waterfowl.

1.3.2.2 Historical Information

1.3.2.2.1 Resident Canada Geese

The Atlantic Flyway Council's Resident Canada Goose Management Plan (Atlantic Flyway Council 1999) contains a detailed history of resident geese in the flyway, and it is summarized and paraphrased here. Resident Canada geese are distinctly different from Canada geese that nested in the Flyway historically. The original stock in pre-colonial times was primarily *B.c. canadensis* (Delacour 1954), but they were extirpated long ago. The present day population was introduced and established during the 1900's by the Pennsylvania Game Commission and various sportsmen's organizations (Atlantic Flyway Council 1999). In 1936, 30 pinioned birds were obtained that started the nucleus of the Pymatuning flock in Crawford County. Over the next several years more birds were obtained from game breeders and through natural reproduction that enabled reintroduction efforts to occur throughout the state. When the use of live decoys for hunting was prohibited in 1935, captive flocks of domesticated or semi-domesticated geese were numerous (more than 15,000 birds), and many were liberated in parks or allowed to wander at large (Dill and Lee 1970). From the 1950s through the 1980s, many AF state wildlife agencies relocated and stocked resident geese, primarily in rural areas. During the 1970's the first nuisance complaints were received from landowners in southeastern Pennsylvania (Atlantic Flyway Council 1999). Subsequent trap and transfer programs relocated over 40,000 problem

geese to new areas both within and outside the state. In 1995 the PGC terminated the trap and transfer program. Populations in rural and urban settings slowly grew through time, with urban populations growing at a faster rate than those nesting in the rural areas (Atlantic Flyway Council 1999).

1.3.2.2.2 Migratory Canada Geese

The original, pre-settlement, stock of Canada geese that occurred in the Atlantic Flyway were *B.c. canadensis* (Delacour 1954 in Atlantic Flyway Council 1999). Canada geese are endemic to North America, where they occur in each state of the United States (except Hawaii), each Province of Canada, and many States of Mexico. Most authorities currently recognize 11 subspecies of Canada geese, which differ primarily in body size and color (Bellrose 1980). Canada goose migrations may encompass up to 3,000 miles, like that of the Richardson's Canada goose (*B.c. hutchinsii*) which nests as far north as Baffin Island, Nunavut, Canada and winters as far south as the eastern States of Mexico. Migrant geese nest across the arctic, subartic, and boreal regions of Canada and Alaska and range in size from the 2-4 pound cackling Canada goose (*B.c. minima*) to the 7-10 pound dusky Canada goose (*B.c. occidentalis*). Currently, there are two populations of Canada geese that occur in Pennsylvania; the Atlantic Population and the Southern James Bay Population.

1.3.2.2.3 Mallard Ducks

Mallards have bred in Pennsylvania for several hundred years (Hartman 1992). Over this period of time their population numbers have fluctuated, dramatically at times. During the first half of the 1900's mallards were most common in northwest and southeast Pennsylvania. At that time, the number of black ducks equaled or surpassed that of the mallards. In the late 1940s and 1950s, Pennsylvania's mallard population expanded as continental populations moved eastward. Mallards moved into the state in response to a large increase in the number of farm ponds. They adapted to farm habitat and suburban environments, and some wintering mallards remained through the breeding season. A limited population increase can be traced to the release of pen-reared mallards and wild mallards breeding with farm ducks (Hartman 1992).

1.3.2.2.4 Mute Swans

The mute swan was introduced, from Europe, into the United States in the late 19th century near New York City. Feral breeding took place after 544 more individuals were introduced in the lower Hudson Valley in 1910 and on Long Island in 1912. In the eastern United States, scattered breeding now occurs from Massachusetts to Virginia (Master 1992). The earliest sighting of mute swans in Pennsylvania was in 1929 at Lake Ontelaunee, Berks county. There were also occurrences in southeastern Pennsylvania, at that time, on the Susquehanna River near Harrisburg. These individuals probably originated in New Jersey, where the species was completely naturalized by 1916. The mute swan was not recorded during the first years of the Breeding Bird Survey. Since 1986, the Atlantic Flyway population of feral mute swans has grown 118%, from 5,800 birds to over 12,600 swans (Atlantic Flyway Council 2000). Increases in mute swan populations may have an impact on native waterfowl species. These swans destroy large amounts of aquatic vegetation while feeding and building nests (Master 1992).

1.3.2.3 Waterfowl Hunting in Pennsylvania

1.3.2.3.1 Resident and Migratory Canada Geese (2002-2003)

There are three distinct seasons for Canada goose hunting in Pennsylvania; the early September season, the regular season, and the late season. The reason for the early and late goose seasons is to allow hunters to target resident Canada goose populations; there are fewer migratory populations in Pennsylvania during the early and late seasons. The regular goose season allows hunters to target both resident and migratory Canada goose populations. There is an early resident Canada goose season for most of PA from September 2 - 25, (5 allowed daily). There is no September goose season in Crawford county south of SR 198 from the Ohio state line to intersection of SR 18, to intersection of US Route 322/ SR18, to intersection of SR 3013, south to the Crawford/Mercer County line or in the controlled hunting area at Middle Creek Wildlife Management Area. The regular Canada goose season (resident and migratory geese) is from Nov.15 - Dec.31 for the Southern James Bay Population (SJBP) zone (2 daily); from Nov.15 - Dec.25 for the Pymatuning zone (1 daily); from Nov.15 - Nov.30 and Dec.15 - Feb.15 for the Resident Population (RP) zone (5 daily); from Nov.15 - Nov.30 and Dec.16 - Jan.20 for the Atlantic Population (AP) zone 1 (2 daily); and from Nov.15 - Nov.30 and Dec.10 - Jan.14 for the AP zone 2 (2 daily). There is also a late resident Canada goose season for most of PA. The season runs from January 15 - February 15 (5 allowed daily).

The Atlantic Population outlook for 2002 was below average production, however, the large size of the breeding population along with new breeding cohorts from the excellent production in 1998, 1999, and 2001 allowed for some increase in hunting. The recovery of this population is continuing while managers carefully expand hunting. In 2002, Pennsylvania's season increased by 15 days to a 45-day season with a 2-goose daily limit (PGC 2002). In the Southern James Bay Population (2002) nest success was the lowest recorded since 1993. In 2002, the overall reproductive effort and nest success will be below average and a fall flight lower than last year is expected. Hunting regulations (2002) for SJBP geese was similar to previous years (PGC 2002). Overall, resident geese numbers are expected to be similar to past years. In 2002, a new resident goose harvest zone was created with a 70-day, 5-goose daily limit.

While these seasons have contributed in targeting harvest of resident geese, additional strategies are needed to effectively manage the resident goose population (Atlantic Flyway Council 1999). Resident geese also avoid hunting mortality through their extensive use of urban and suburban environments. Resident Canada goose harvest rates are not uniform throughout a large area such as a state. Harvest rates greater than 25% may occur during special seasons in some rural areas, while geese in urban-suburban areas may experience no harvest at all in some years (Atlantic Flyway Council 1999). In Pennsylvania, overall harvest rates are higher since the inception of September seasons averaging near 20%, but are still believed to be well below that necessary to stabilize population growth (Dunn and Jacobs 2000). Urban-suburban areas often provide exceptional goose habitat and allow geese to remain in "refuges" and avoid peak harvest periods

(i.e., weekends). Geese that live near people also often benefit from the availability of food handouts. Urban-suburban geese however, are subjected to herbicides, pesticides, pollution, automobiles, illegal take, pets, and transmission of disease from domestic birds (U.S. Fish and Wildlife Service 2001). Non urban-suburban geese are also subject to these same affects, albeit at differing rates.

Table 4. Number of Canada geese harvested in Pennsylvania during Early September, Regular, and Late January Seasons during 1995-2001 (PGC 2001).

Year	Number of Geese Harvested Early September Season	Number of Geese Harvested Regular Season	Number of Geese Harvested Late January Season	Total
1995*	40,900	14,200	1,700	56,800
1996	51,000	21,000	19,300	91,300
1997	64,500	20,700	19,300	104,510
1998	63,200	16,400	11,400	91,000
1999	59,500	26,400	8,800	94,700
2000	48,800	21,200	11,700	81,700
2001	63,700	43,100	18,900	125,800

***1995 early season was held in only 26 counties;**
Beginning in 1996 early season was expanded to statewide.

1.3.2.3.2 Mallard Ducks

Pennsylvania is split into four duck zones; Lake Erie zone, Northwest zone, North zone, and South zone. The Lake Erie zone encompasses Lake Erie, Presque Isle and the area within 150 yards of the Lake Erie shoreline. The Northwest zone includes the area bounded on the north by the Lake Erie zone and including all of Erie and Crawford counties and all of Mercer and Venango counties north of I-80. The North zone includes the area east of the Northwest zone and north of I-80 to route 220, north from I-80 to I-180, north and east of I-180 from route 220 to I-80, north of I-80 from I-180 to the Delaware River. The South zone is all of the state not included in the Lake Erie, Northwest, or North zones (PGC 2002).

2002 open season on mallard ducks (by zone):

Lake Erie Zone: October 28 - November 16 and November 25 - January 11.

North Zone: October 5 - 19 and November 12 - January 4.

Northwest Zone: October 5 - 19 and November 9 - January 2.

South Zone: October 5 - 12 and November 15 - January 15.

The 2002 bag limit on ducks was 6 daily; may not include more than 4 mallards including 2 hens, 1 black duck, 1 pintail, 1 mottled duck, 1 fulvous tree duck, 2 wood ducks, 2 redheads, 4 scoters and 3 scaup. Possession limit is twice the daily bag limit (PGC 2002).

Table 5. Harvest Estimates for Mallard Ducks (USFWS) and all Duck Species (PGC) in Pennsylvania (1994-2001).

Year	Number of Mallards Harvested	Number of all Duck Species Harvested
1994	50,100	128,160
1995	50,500	156,510
1996	56,600	152,470
1997	71,000	191,800
1998	60,900	146,050
1999	66,100	169,900
2000	59,900	187,104
2001	63,400	143,907

1.3.2.3.3 Mute Swans and Domestic or Feral Waterfowl

The take of feral ducks and geese (including cross-breeds) is not regulated by any state regulations. These species can be taken during and outside of existing hunting seasons. The exception is the mute swan due to the recent Federal court decision which excluded them from feral waterfowl status.

1.3.3 Waterfowl Damage and Conflicts

The management of waterfowl damage to protect human health, human safety, property, agriculture and natural resources invariably leads to a better quality of life for affected parties. WS is not legislatively mandated to protect quality of life, but it is accomplished, indirectly, as a secondary result of waterfowl damage management practices. In Pennsylvania, the WS program received 138 waterfowl damage-related requests for assistance for fiscal year 2002 (Table 6). Requests are categorized according to resource category (agriculture, property, natural resources, and human health and safety) and location. Damage to property (100 requests, 79% of requests), and human health and safety (19 requests, 15%) are the most frequent types of damage. Requests for assistance with damage to agriculture (8 requests) and natural resources (no requests) are less frequent (Table 6).

Most nuisance complaints are associated with suburban areas where waterfowl congregate on public or private ponds and forage on lawns and mowed areas associated with parks, beaches, golf courses, schools, business campuses, and residences. The major problems are associated with the impacts of feces and grazing damage to lawns and other areas (including sidewalks, driveways, swimming pools, etc.). Agricultural losses occur primarily in the late winter and spring. The major crops damaged are corn, soybeans, winter wheat and improved pastures.

Table 6. Number of requests for damage management assistance regarding Canada geese, mallards, and feral waterfowl received by USDA APHIS Wildlife Services during Federal Fiscal years 2000, 2001, and 2002 (USDA unpublished reports).

Species	Agriculture	Property	Natural Resources	Human Health & Safety	Total
Feral (ducks & geese)	0	5	0	0	5
Canada geese	32	201	3	39	275
Mallards	1	17	0	3	21
Total	33	223	3	42	301

1.3.3.1 Waterfowl Threats to Human Health

Waterfowl conflicts may potentially impact human health. For instance, a foraging Canada goose defecates between 5.2 and 8.8 times per hour (Bedard and Gauthier 1986). Kear (1963 In Allan et al. 1995) recorded a maximum fecal deposition rate for Canada geese of 0.39 pounds per day (dry weight). Public swimming beaches, private ponds, and lakes can be affected by goose droppings. There are several pathogens involving waterfowl which may be contracted by humans, however, the risk of infection is believed low (Centers for Disease Control and Prevention (CDCP) 1998).

Cryptosporidiosis is a disease caused by the parasite *Cryptosporidium parvum* and was not known to cause disease in humans until as late as 1976 (CDCP 1998). A person can be infected by drinking contaminated water or direct contact with the droppings of infected animals (CDCP 1998). The public is advised to be careful when swimming in lakes, ponds, streams, and pools, and to avoid swallowing water while swimming (Colley 1996). The public is also advised to avoid touching stools of animals and to drink only safe water (Colley 1996). *Cryptosporidium* can cause gastrointestinal disorders (Virginia Department of Health 1995) and produce life threatening infections in immunocompromised and immunosuppressed people (Roffe 1987, Graczyk et al. 1998). Cryptosporidiosis is recognized as a disease with implications for human health (Smith et al. 1997). Giardiasis (*Giardia lambia)* is an illness caused by a microscopic parasite that has become recognized as one of the most common causes of waterborne disease in humans in the United States during the last 15 years (CDCP 1999). Giardiasis is contracted by swallowing contaminated water or putting anything in your mouth that has touched the stool of an infected animal pr person, and causes diarrhea, cramps and nausea (CDCP 1999).

Salmonella *(Salmonella spp.)* may be contracted by humans by handling materials soiled with bird feces (Stroud and Friend 1987). Salmonella causes gastrointestinal illness, including diarrhea.

Chlamydia psittaci, which can be present in diarrhetic feces of infected waterfowl, can be transmitted if it becomes airborne (Locke 1987). Severe cases of Chlamydiosis have occurred among wildlife biologists and others handling snow geese, ducks, and other birds (Wobeser and Brand 1982). Chlamydiosis can be fatal to humans if not treated with antibiotics. Waterfowl,

herons, and rock doves (pigeons) are the most commonly infected wild birds in North America (Locke 1987).

Escherichia coli (*E. coli*) are fecal coliform bacteria associated with fecal material of warm blooded animals. There are over 200 specific serological types of E. coli and the majority are harmless (Sterritt and Lester 1988). Probably the best known serological type of *E. coli* is *E. coli* O157:H7, which is a harmful *E. coli* usually associated with cattle (Gallien and Hartung 1994). This was the rationale for testing public water supplies that was developed in the United States and Europe at the turn of the century to reduce the incidence of waterborne diseases.

Regardless of whether the serological types of *E. coli* disseminated into watersheds by waterfowl are proven to be harmful to humans, it has been demonstrated that Canada geese can disseminate *E. coli* into the environment and result in elevated fecal coliform densities in the water column (Hussong et al. 1979). Many communities monitor water quality at swimming beaches, but lack the financial resources to pinpoint the source of elevated fecal coliform counts. When fecal coliform counts at swimming beaches exceed established standards the beaches are temporarily closed adversely affecting the human quality of life, even though they may not have been able to determine the serological type of the *E. coli*. Unfortunately, linking the elevated bacterial counts to frequency of waterfowl use and attributing the elevated levels to human health threats has been problematic until recently. Advances in genetic engineering have allowed microbiologists to match genetic code of coliform bacteria to specific animal species and link these animal sources of coliform bacteria to fecal contamination (Jamieson 1998, Simmons et al. 1995). Simmons et al. (1995) used genetic fingerprinting to link fecal contamination of small ponds on Fisherman Island, Virginia to waterfowl. Microbiologists were able to implicate waterfowl and gulls as the source of fecal coliform bacteria at the Kensico Watershed, a water supply for New York City (Klett et al. 1998). Also, fecal coliform bacteria counts coincided with the number of Canada geese and gulls roosting at the reservoir.

Roscoe (1999) conducted a survey to estimate the prevalence of pathogenic bacteria and protozoa in resident Canada geese in NJ, and found no *Salmonella* sp., *Shigella* sp., or *Yersinia* sp. isolated from any of the 500 Canada goose samples. However, he did report finding *Cryptosporidium* sp. in 49 (10%) of the 500 geese, and *Giardia* sp. in 75 (15%) of the geese. Additionally, the USGS (U.S. Geological Survey 2000) conducted field studies in NJ, VA, and MA to determine the presence of organisms that could cause disease in human exposed to feces of Canada geese at sites with a history of high public use and daily use by geese. *Salmonella spp.*, *Listeria spp.*, *Chlamydia sp.*, and *Giardia spp.* were isolated from goose feces in New Jersey (U.S. Geological Survey 2000).

While transmission of disease or parasites from waterfowl to humans has not been well documented, the potential exists (Luechtefeld et al. 1980, Wobeser and Brand 1982, Hill and Grimes 1984, Pacha et al. 1988, Blandespoor and Reimink 1991, Graczyk et al. 1997, Saltoun, et al. 2000). In worst case scenarios, infections may even be lifethreatening for immunocompromised and immunosuppressed people (Roffe 1987, Virginia Department of Health 1995, Graczyk et al. 1998). Even though many people are concerned about disease

transmission from feces, the probability of contracting disease from feces is believed to be small. Financial costs related to human health threats involving waterfowl may include testing of water for *coliform* bacteria, cleaning and sanitizing beaches regularly of feces, contacting and obtaining assistance from public health officials, and implementing non-lethal and lethal methods of wildlife damage management. WS recognizes and defers to the authority and expertise of local and state health officials in determining what does or does not constitute a threat to public health.

1.3.3.2 Need to Protect Human Safety from Waterfowl

Bird strikes cause an estimated seven fatalities involving civilian and military aircraft each year (Linnell et al. 1996). For the period 1990-2000, waterfowl (geese and ducks) comprise 11% of all bird-aircraft strikes to civil aviation reported to the FAA for which bird species or group was reported (Cleary et al. 2002). For the period 1990-2000, more than 50% of Canada goose-aircraft strikes resulted in damage to the aircraft, and 28.5% resulted in a negative effect on the flight (Cleary et al. 2002). For example, in 1995, a Boeing 707 E38 AWACS jet taking off from Elmendorf Air Force Base in Alaska ingested at least 13 geese into the number 1 and 2 engines and crashed, killing all 24 crew members. The Canada goose is the most massive bird (8-15 pounds) that is commonly struck by aircraft, and nationally, this species was responsible for a disproportionately large amount of damage to civil aircraft involved in strikes with wildlife during 1990-2000 (Cleary et al. 2000). Nationally, the resident Canada goose population probably represents the single most serious bird threat to aircraft safety at this time (Alge 1999 in Cleary et al. 2000). It is estimated that only 20-25% of all bird strikes are reported (Conover et al. 1995, Dolbeer et al. 1995, Linnell et al. 1996, Linnell et al. 1999).

Waterfowl aggressively defend their nests, nesting areas, and young, and may attack or threaten pets, children, and adults (Smith et al. 1999). Additionally, slipping hazards can be created by the buildup of feces from waterfowl on docks, walkways, and other foot traffic areas, especially near nesting areas where waterfowl spend a considerable amount of time during a concentrated time period (April-May). WS records show traffic hazards result from waterfowl straying into busy streets and highways and can result in accidents as vehicles try to avoid hitting the birds (Wisconsin WS, unpubl. data).

1.3.3.3 Need to Protect Property from Waterfowl

Waterfowl may cause damage to aircraft, landscaping, piers, yards, boats, beaches, shorelines, parks, golf courses, driveways, athletic fields, ponds, lakes, rafts, porches, patios, gardens, foot paths, swimming pools, play grounds, school grounds, and cemeteries. Damage reported through technical assistance generally is not verified by field investigation by WS. The majority of people that contact WS for assistance describe a general decline in their quality of life due to local overabundance of waterfowl. In many cases, people are unable to use and enjoy their own property, public parks, and other areas because of waterfowl feces. Costs associated with property damage include labor and disinfectants to clean and sanitize the area, loss of property use and resale value, loss of aesthetic value of plants, gardens, aquatic vegetation, and lawns where waterfowl feed and loaf, loss of customers or visitors irritated by having to walk on feces, and loss of time contacting wildlife management agencies on health and safety issues and

damage management advice, and implementation of non-lethal and lethal wildlife management methods.

The costs of reestablishing overgrazed lawns and cleaning waterfowl feces from sidewalks have been estimated at more than $60 per bird (Allan et at. 1995).

1.3.3.4 Need to Protect Agriculture from Waterfowl

The most common waterfowl damage to agriculture is primarily crop consumption (loss of the crop and revenue), but also consists of unacceptable accumulations of feces on horse pastures, trampling of wheat, and increased erosion and runoff from fields where the cover crop has been grazed. During Federal Fiscal Year 2002 a total of 8 requests for assistance were received by WS regarding waterfowl damage to agriculture in Pennsylvania. During Fiscal Year 2002, a total of 6 Pennsylvania farmers experienced waterfowl-related crop damage to the extent that a Federal permit to shoot or otherwise remove waterfowl was pursued.

1.3.3.5 Need to Protect Natural Resources from Waterfowl

Soil erosion and sedimentation can cause damage to natural resources. Excessive numbers of waterfowl can remove bank vegetation resulting in erosion of the shoreline and soil sediments being carried by rainwater into lakes, ponds and reservoirs. Waterfowl may cause damage to natural vegetation, shorelines, parks, ponds, and lakes. Overabundant resident Canada geese can negatively impact crops and habitats maintained as food and cover for migrant Canada geese and native waterfowl and other wildlife.

The mallard is a common species of waterfowl that frequents northeastern aquaculture facilities. Where predation situations occur, mallards achieve extremely high densities throughout the day and have adapted to feed in trout raceways stocked with high densities of smaller fish. Mallards generally consume 4 fish per hour, with the fish averaging 4 inches in length. In other situations, mallards may feed on only aquatic vegetation or fish feed, so careful observations are essential to determine whether losses of fish are occurring (USDA 1997).

Nutrient loading has been found to increase in wetlands in proportion to increases in the numbers of roosting geese (Kitchell et al. 1999, Manny et al. 1994). In studying the relationship between bird density and phosphorus (P) and nitrogen (N) levels in Bosque Del Apache National Wildlife Refuge in New Mexico, Kitchell et al. (1999) found an increase in the concentration of both P and N correlated with an increase in bird density. Scherer et al. (undated) stated that waterfowl metabolize food very rapidly and most of the phosphorus contributed by bird feces probably originates from sources within a lake being studied. In addition, assimilation and defecation converted the phosphorus into a more soluble form and, therefore was considered a form of internal loading. Waterfowl have contributed substantial amounts of P and N into lakes through feces creating excessive aquatic macrophyte growth and algae blooms (Scherer et al. undated) and accelerated eutrophication through nutrient loading (Harris et al. 1981).

Waterfowl are considered by the American Association of Wildlife Veterinarians (AAWV) as susceptible to and carriers of disease and parasites. Because of the potential threat to free-ranging

waterfowl, the AAWV put forth the following resolution (AAWV, undated): ...wild and semi-domestic ducks, geese and swans are susceptible to and carriers of disease and parasites of free-ranging wild ducks, geese, and other birds;..."
...the AAWV encourages local authorities and state and federal agencies to cooperate to limit the population of waterfowl on urban water areas to prevent disease outbreaks in semi-domestic as well as free ranging ducks, geese and swans and discourages the practice of relocating nuisance or excess urban ducks, geese and swans to other parks or wildlife areas as a means of local population control."

1.4 WS RECORD KEEPING REGARDING REQUESTS FOR WATERFOWL DAMAGE MANAGEMENT ASSISTANCE

WS maintains a Management Information System (MIS) database to document assistance that the agency provides in addressing wildlife damage conflicts. MIS data is limited to information that is collected from people who have requested services or information from Wildlife Services. It does not include requests received or responded to by local, State or other Federal agencies, and it is not a complete database for all wildlife damage occurrences. The number of requests for assistance does not necessarily reflect the extent of need for action, but this data does provide an indication that needs exists.

The database includes, but not limited to, the following information: species of wildlife involved, the number of individuals involved in a damage situation; tools and methods used or recommended to alleviate the conflict; and the resource that is in need of protection. Table 6 provides a summary of Technical Assistance projects completed by the Pennsylvania WS program for Fiscal Year 2002. A description of the WS Technical Assistance program in Pennsylvania is described in Chapter 3 of this EA.

1.5 RELATIONSHIP OF THIS ENVIRONMENTAL ASSESSMENT TO OTHER ENVIRONMENTAL DOCUMENTS

WS conducted a NEPA process and developed a Final Environmental Impact Statement (FEIS) on the national APHIS/WS program (USDA 1997). The FEIS contains detailed discussions of potential environmental impacts from various wildlife damage management methods. Council on Environmental Quality regulations for implementing NEPA authorize agencies to eliminate repetitive discussions of issues addressed in programmatic documents by tiering to the broader document (CFR 1500.4(I);1502.20). Therefore, this EA is tiered to the FEIS, and pertinent information available in the FEIS has been incorporated by reference into this EA. The FEIS may be obtained by contacting: USDA APHIS WS Operational Support Staff, 4700 River Rd., Unit 87, Riverdale, MD 20737-1234.

1.6 DECISIONS TO BE MADE

Based on the scope of this EA, the decisions to be made are:

I. Should WS implement a Waterfowl Damage Management program in Pennsylvania?

II. If not, how should WS fulfill its legislative responsibilities for managing conflicts associated with waterfowl in Pennsylvania?

III. Might the proposed WS program have significant impacts requiring preparation of an EIS?

1.7 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

1.7.1 Actions Analyzed

This EA evaluates waterfowl damage management by WS to protect human health, human safety, property, natural resources and agriculture on private land or public facilities whenever or wherever such management is requested from the WS program in Pennsylvania.

1.7.2 American Indian Lands and Tribes

Currently WS does not have any MOUs or signed agreements with any American Indian tribe in Pennsylvania. If WS enters into an agreement with a tribe, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA.

1.7.3 Period for which this EA is Valid

This EA will remain valid until WS determines that new needs for action or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and revised as necessary. This EA will be reviewed each year to ensure that it is complete and still appropriate to the scope of WS state waterfowl damage management activities.

1.7.4 Site Specificity

This EA analyzes potential impacts of WS's waterfowl damage management activities that will occur or could occur at private property sites or at public facilities in all 67 counties in Pennsylvania. Because the proposed action is to implement an Integrated Waterfowl Damage Management program, and because Pennsylvania WS program goals and responsibilities are to provide service when requested within the constraints of available funding and personnel, it is conceivable that waterfowl damage management activities by WS could occur anywhere in state. The EA emphasizes significant issues as they relate to specific areas whenever possible. However, the issues that pertain to the various types of waterfowl damage and resulting management are the same, for the most part, wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) and WS Directive 2.105 is employed for determining methods and strategies to use or recommend for individual actions conducted by WS (See USDA 1997, Chapter 2 and Appendix N for a more complete description of the WS Decision Model and examples of its application). Decisions made using this process will be in accordance with any mitigation measures and standard operating procedures described herein and adopted or established as part of the decision.

1.7.5 Public Involvement/Notification

As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified. New

issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

1.8 AUTHORITY AND COMPLIANCE

1.8.1 Authority of Federal and State Agencies in Waterfowl Damage Management in Pennsylvania

See Chapter 1 of USDA (1997) for a complete discussion of federal laws pertaining to WS.

1.8.1.1 WS Legislative Authority

The USDA is authorized by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services program is the Act of 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468), and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c), and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001, Public Law 106-387, October 28, 2000. Stat. 1549 (Sec 767), which provides that:

> *The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."*

Since 1931, with the changes in societal values, WS policies and programs place greater emphasis on the part of the Act discussing "*bringing (damage) under control*," rather than "*eradication*" and "*suppression*" of wildlife populations. In 1988, Congress strengthened the legislative authority of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

> *"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with states, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."*

1.8.1.2 U.S. Fish and Wildlife Service (USFWS)

The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the MBTA and those that are listed as threatened and endangered (T&E) species under the ESA. Sections 1.8.2.2 and 1.8.2.3 below describe WS interactions with the USFWS

under these two laws. Under the permitting application process, the USFWS requires applicants to describe prior non-lethal damage management techniques that have been used.

1.8.1.3 Pennsylvania Game Commission (PGC)

The Pennsylvania Game Commission is charged by law 322(a) Title 34 "to protect, propagate, manage, and preserve the game or wildlife of this Commonwealth and to enforce, by proper actions and proceedings, the law of this Commonwealth relating thereto."

1.8.2 Compliance with Other Federal Laws

Several other federal laws authorize, regulate, or otherwise affect WS wildlife damage management. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.8.2.1 National Environmental Policy Act (NEPA)

WS prepares analyses of the environmental impacts of program activities to meet procedural requirements of this law. This EA meets the NEPA requirement for the proposed action in Pennsylvania. When WS direct management assistance is requested by another federal agency, NEPA compliance is the responsibility of the other federal agency. However, WS could agree to complete NEPA documentation at the request of the other federal agency.

1.8.2.2 Endangered Species Act (ESA)

It is federal policy, under the ESA, that all federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available*" (Sec.7(a)(2)). WS obtained a Biological Opinion (B.O.) from the U.S. Fish and Wildlife Service (USDI 1992) describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F).

1.8.2.3 Migratory Bird Treaty Act of 1918 (U.S.C. 703711: 40 Stat. 755), as amended

The MBTA provides the USFWS regulatory authority to protect families of birds that contain species which migrate outside the United States. The law prohibits any "*take*" of these species by private entities, except as permitted by the USFWS; therefore the USFWS issues permits to private entities for reducing bird damage. WS will obtain MBTA permits covering waterfowl damage management activities that involve the taking of species for which such permits are required in accordance with the MBTA and USFWS regulations, or will operate as a named agent on MBTA permits obtained by cooperators.

1.8.2.4 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The U. S. Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All pesticides used by the WS program in Pennsylvania are registered with

and regulated by the EPA and Pennsylvania Department of Agriculture, Trade and Consumer Protection, and are used by WS in compliance with labeling procedures and requirements. No toxicants are currently used or registered for use in managing waterfowl or reducing waterfowl damage. There are several repellents that are registered for use in reducing waterfowl damage to vegetation in Pennsylvania. An example of one that is Methyl Anthranilate based is ReJeX-iT™. Two other repellents that are commonly used are AG-36™ and FlightControl™ (Antraquinone based repellent).

1.8.2.5 Investigational New Animal Drug (INAD)

The drug alphachloralose (AC) has been used as a sedative for animals and is registered with the Food and Drug Administration (FDA) to capture waterfowl, coots, and pigeons. FDA approval for use under INAD (21 CFR, Part 511) authorized WS to use the drug as a non-lethal form of capture.

1.8.2.6 National Historic Preservation Act (NHPA) of 1966, as amended

The National Historic Preservation Act (NHPA) of 1966, and its implementing regulations (36 CFR§800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS actions on tribal lands are only conducted at the tribes request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. Waterfowl damage management could benefit historic properties if such properties were being damaged by waterfowl. In those cases, the officials responsible for management of such properties would make the request and would select the methods to be used in their waterfowl damage management program. Harassment techniques that involve noise making could conceivably disturb users of historic properties if they were used at or in close proximity to such properties; however, it would be an exceedingly rare event for noise producing devices to be used in close proximity to such a property unless the resource being protected from waterfowl damage was the property itself, in which case the primary effect would be beneficial. Also, the use of such devices is generally short term and could be discontinued if any conflicts with historic properties arose. WS has determined waterfowl damage management actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties.

1.8.2.7 Environmental Justice and Executive Order 12898 "*Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.*"

Executive Order 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" promotes the fair treatment of people of all races,

income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Environmental Justice is a priority within APHIS and WS. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies and activities on minority and low income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low income persons or populations. Additionally, the donation of processed goose meat products at no cost to food shelf operations within Pennsylvania would be a benefit to the economically disadvantaged or other persons in need.

1.8.2.8 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposal might have on children. The proposed waterfowl damage management program would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action. Additionally, since the proposed waterfowl damage management program is directed at reducing accumulations of feces, waterfowl aggression, denuding of landscaped vegetation, etc., at schools, public parks, playgrounds, private properties and other locations where children are sometimes present, it is expected that health and safety risks to children would be reduced.

1.8.2.9 Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186)

Executive Order 13186 requires each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement, a Memorandum of Understanding (MOU) with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this EO and is currently waiting for USFWS approval. WS will abide by the MOU once it is finalized and signed by both parties.

1.8.3 Compliance with Other State Laws

In Pennsylvania, Canada geese and mallards are classified as a protected game bird species, and they are hunted in Pennsylvania. Waterfowl hunting seasons in Pennsylvania are fully described in Section 1.3.2.3. Depredation permits issued by the USFWS for properties in Pennsylvania are co-signed by the Pennsylvania Game Commission, so that in PA, one depredation permit

provides both federal and Pennsylvania authorization. Typically, depredation permits that authorize the take of birds and the subsequent processing for donation to charitable organizations provide for the take according to prescribed methods (including shooting and capture/euthanize) and the transport (for slaughter and donation). Disposition of waterfowl taken under permits or other federal and state authorizations, typically includes donation to public/education institutions, burial, incineration, and process/donate.

2.0 CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

Chapter 2 contains a discussion of issues that received detailed environmental impact analysis in Chapter 4 (Environmental Consequences) and issues not considered in detail, with rationale. Portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional affected environments are incorporated into the discussion of the environmental impacts in Chapter 4 and the description of the current program in Chapter 3.

2.1 AFFECTED ENVIRONMENT

The areas of the proposed action include, but are not limited to, property on or adjacent to airports, golf courses, athletic fields, recreational areas, swimming beaches, parks, corporate complexes, subdivisions, businesses, industrial parks, schools, agricultural areas, wetlands, restoration sites, and cemeteries. The proposed action may be conducted on properties held in private, local, state or federal ownership.

2.2 ISSUES

The following issues have been identified as areas of concern requiring consideration in this EA. These will be analyzed in detail in Chapter 4:

I. Effects on Target Waterfowl Populations
II. Effectiveness of Wildlife Damage Management Methods
III. Effects on Aesthetic Values
IV. Humaneness and Animal Welfare Concerns of Methods Used by WS
V. Effects on Non-target Wildlife Species Populations, Including T&E Species

2.3 ISSUES ADDRESSED IN THE ANALYSIS OF ALTERNATIVES

2.3.1 Effects on Target Waterfowl Populations

A common concern among members of the public is whether wildlife damage management actions adversely affect the viability of target wildlife species populations. The target species analyzed in this EA are Canada geese, mallards, mute swans, and domestic and feral waterfowl.

2.3.2 Effectiveness of Wildlife Damage Management Methods

Another common concern among members of the public is whether the methods of reducing waterfowl damage will be effective in reducing or alleviating the damage/conflict. The effectiveness of each alternative can be defined in terms of decreased potential for health risks, decreased human safety hazards, reduced property damage, reduced agricultural damage, reduced natural resource damage and improved quality of life.

2.3.3 Affects on Aesthetic Values

Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetic values are subjective, and depend on what an observer regards as beautiful.

Generally, wildlife is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit for many people. However, wildlife may also be responsible for adverse affects to people. The activities of some wildlife result in economic losses to agriculture and damage to property. Human safety is jeopardized by wildlife collisions with aircraft and automobiles, aggressive waterfowl behavior sometimes results in human injury, and wild animals may harbor diseases transmissible to humans.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and is a part of the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is the knowledge that the animals exist (Decker and Goff 1987). Positive values of wildlife would also include having enough wildlife to view. However, the same wildlife populations that are generally appreciated may also create conflicts with land uses and human health and safety. Certain species of wildlife can be regarded as a nuisance in certain settings. Large numbers of waterfowl can reduce the aesthetic appearance and enjoyment of some activities and locations because of excessive feces, waterfowl aggression and human injury, denuded vegetation, eroded streambanks, disruption of vehicle traffic, etc. In sum, aesthetics include those values people place on waterfowl, knowledge of their existence and occurrence in their area, ability to enjoy and use properties for their intended purpose without excessive feces present, and ability to enjoy the natural and landscaped vegetation of an area.

Public reaction is variable and mixed among people because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wildlife. Population management methods (egg destruction, capture and relocation, capture and euthanize, and shooting) may provide relief from damage in situations where non-lethal methods were ineffective or impractical. Many people directly affected by damage to property and threats to human safety caused by waterfowl chose removal of the birds from the property when the WAC has been exceeded. Some people believe that waterfowl should be captured and relocated to another area to alleviate damage or threats to human safety. Some people directly affected by the damage from waterfowl sometimes oppose removal of the birds regardless of the amount of damage. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to removal of waterfowl from specific locations or sites. Some of the totally opposed people want WS to teach tolerance for waterfowl damage and threats to human health and safety, and that waterfowl should never be killed. Some of the people who oppose removal of waterfowl do so because of human affectionate bonds with individual birds. These human affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Some wildlife habituate easily and live in close proximity to humans. Some people in these situations feed wildlife and/or otherwise develop emotional attitudes toward the animals that result in aesthetic enjoyment. In addition, some people consider individual wild birds as "pets," or exhibit affection toward these animals. Examples would be people who visit a city park to feed waterfowl and homeowners who have bird feeders or bird houses. Many people do not develop emotional bonds with individual wild animals, but experience aesthetic enjoyment from observing them.

Some property owners that have populations of waterfowl above their identified WAC are concerned about the negative aesthetic appearance of feces and property damage to landscaping and turf. Managers of golf courses, swimming beaches and athletic fields are particularly concerned because negative aesthetics can result in reduced public use.

2.3.4 Humaneness and Animal Welfare Concerns of Methods used by WS

Humaneness, in part, is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently.

Research indicates that the public may be willing to accept lethal wildlife management methods if they are humane (i.e., minimize pain and suffering of the target animal) (Kellert 1993, Schwartz et al. 1997). The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important and complex concept. Wildlife damage management for societal benefits could be compatible with animal welfare concerns if ". . . *the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process" (Schmidt 1989).* Suffering is described as a *" . . . highly unpleasant emotional response usually associated with pain and distress",* however, suffering *" . . . can occur without pain . . . ,"* and *" . . . pain can occur without suffering . . . "* (AVMA 1987). Because suffering carries with it the implication of a time frame, suffering is considered to be minimized where death is immediate (CDFG 1991) such as occurs with proper shooting.

Defining pain as a component in humaneness of WS methods is a greater challenge than that of suffering. Pain occurs in animals. Altered physiology and behavior can be indicators of pain, and the causes that elicit pain responses in humans would *" . . . probably be causes for pain in other animals . . . "* (AVMA 1987). Pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991). One challenge with coping with this issue is how to achieve the least amount of animal suffering within the constraints of current technology and resources. Additionally, *" . . . neither medical or veterinary curricula explicitly address suffering or its relief"* (AVMA 1987, CDFG 1999).

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some waterfowl damage management methods are used.

WS personnel in Pennsylvania are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures and standard operating procedures used to maximize humaneness are listed in Chapter 3.

2.3.5 Effects on Non-target Wildlife Species Populations, Including T&E Species

WS and the public are concerned about the potential impact of damage management methods and activities on non-target species, particularly T&E species. WS's standard operating procedures include measures intended to mitigate or reduce the effects on non-target and T&E species populations and are presented in Chapter 3.

2.4 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

2.4.1 Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area

Some individuals might question whether preparing an EA for an area as large as the State of Pennsylvania would meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. The WS program is analogous to other agencies or entities with damage management missions such as fire and police departments, emergency cleanup organizations, insurance companies, etc. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage will occur, the program cannot predict the specific locations or times at which affected resource owners will determine a damage problem has become intolerable to the point that they request assistance from WS. In addition, the WS program would not be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and state agencies. Such broad scale population management would also be impractical or impossible to achieve within WS policies and professional philosophies.

If a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire state provides a better analysis than multiple EA's covering smaller zones.

2.4.2 Effects on Human Health from Consumption of Waterfowl

To reduce potential health risks associated with consuming waterfowl, all waterfowl donated for human consumption would be tested for exposure to organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals prior to distribution. The entity selecting the capture/euthanize (and donation for charitable consumption) program would be responsible for all costs associated with legal and appropriate donation for human consumption. In Pennsylvania, captured waterfowl which would be donated for human (charitable) donation by WS would typically be euthanized, processed by a poultry processing facility, tested for contaminants, and then transported legally to the food bank. All processed

meat would be packaged, frozen and stored at the processing site until test results were received. Head, kidney and liver samples would be tested for exposure to organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals. Tests, in most cases, would be conducted by the Pennsylvania Animal Diagnostic Laboratory System (PADLS) in Kennett Square, PA. Poultry processing facilities utilized for this process would be in compliance with existing USDA regulations pertaining to the processing and handling of fowl (turkeys, chickens, etc.). There are no Pennsylvania regulations that provide further guidance in the processing and distribution of waterfowl carcasses for consumption by people (charitable donation).

3.0 CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992) as described in Chapter 2 (pages 20-35), Appendix J (Methods of Control), Appendix N (Examples of WS Decision Model), and Appendix P (Risk Assessment of Wildlife Damage Control Methods Used by USDA, Wildlife Services Program) of the ADC FEIS (USDA 1997).

Chapter 3 contains a discussion of the program alternatives, including those that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), alternatives considered but not analyzed in detail, with rationale, and mitigation measures and SOP's for wildlife damage management techniques. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Evaluation of the affected environments will be addressed in more detail in Chapter 4.

3.1 DESCRIPTION OF THE ALTERNATIVES

The No Action alternative is a procedural NEPA requirement (40 CFR 1502), is a viable and reasonable alternative that could be selected, and serves as a baseline for comparison with the other alternatives. The No Action alternative, as defined here, is consistent with the Council on Environmental Quality's (CEQ's) definition (CEQ 1981).

3.2 WATERFOWL DAMAGE MANAGEMENT STRATEGIES AND METHODOLOGIES AVAILABLE TO WS IN PENNSYLVANIA

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2, and 3 described in Section 3.3. Alternative 4 would terminate both WS technical assistance and operational wildlife damage management WS. Appendix B is a more thorough description of the methods that could be used or recommended by WS.

3.2.1 Integrated Wildlife Damage Management (IWDM).

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective[1] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (i.e., no feeding policies), habitat modification (i.e., exclusion), animal behavior modification (i.e., scaring), and removal of individual offending animals (i.e., relocation), local population reduction, or any combination of these, depending on the circumstances of the specific damage problem. WS considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al 1992). The recommended strategy(ies) may include any combination of preventive and corrective actions

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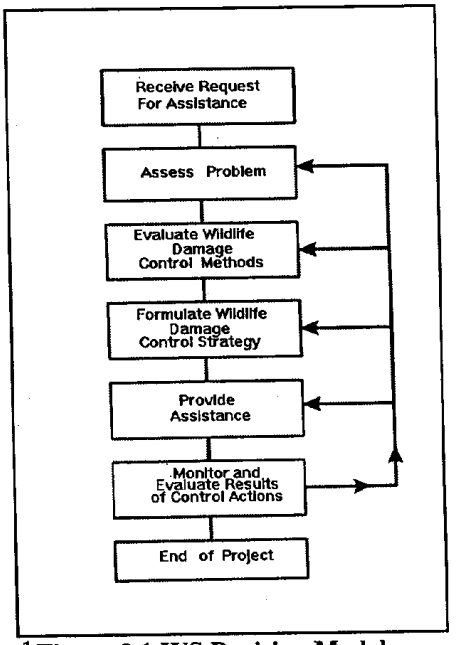
1 The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns

that could be implemented by the requester, WS, or other agency personnel, as appropriate. Two strategies are available:

1. **Preventive Damage Management** is applying wildlife damage management strategies before damage occurs, based on historical problems and data. All non-lethal methodologies, whether applied by WS or resource owners, are employed to prevent damage from occurring and therefore fall under this heading. When requested, WS personnel provide information and conduct demonstrations, or take action to prevent additional losses from recurring. An example would be a cooperator installing and maintaining a fence and/or overhead wire grid system to reduce access of waterfowl to a retention pond or scaring waterfowl away from active runways.

2. **Corrective Damage Management** Corrective damage management is applying wildlife damage management to stop or reduce current losses. As requested and appropriate, WS personnel provide information and conduct demonstrations, or take action to prevent additional losses from recurring. An example would be the removal of waterfowl during the summer molt using round-up techniques or the oiling of eggs during the nesting season. Often, this involves the lethal removal of individual animals.



1**Figure 3.1 WS Decision Model**

3.2.2 WS Decision Making

WS personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model described by Slate et al. (1992) (Figure 1). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS personnel assess the problem; evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not necessarily a documented process, but is a mental problem-solving process common to most if not all professions.

3.2.3 The IWDM Strategies that WS Employs

Technical Assistance Recommendations (implementation is the responsibility of the requestor):
Technical assistance is information, demonstrations, and advice on available and appropriate wildlife damage management methods. Technical assistance may require substantial effort by WS personnel in the decision making process, but the implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use. Technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems, these strategies are based on the level of risk, need, and the practicality of their application.

Under APHIS' NEPA Implementing Regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

Direct Damage Management Assistance (implementation is conducted or supervised by WS personnel):
Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone, and when *Agreements for Control* or other comparable instruments provide for WS direct control damage management. The initial investigation defines the nature, history, extent of the problem, species or property directly and indirectly damaged species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS personnel are often required to effectively resolve problems, especially if restricted use pesticides are necessary, or if the problem is complex. Direct damage management provided by WS in Pennsylvania is provided on a cost-reimbursable (contract) basis.

Educational Efforts:
Education is an important element of WS program activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to producers, homeowners, state and county agents, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are periodically updated on recent developments in damage management technology, laws and regulations, and agency policies.

Research and Development:
The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. NWRC research was instrumental in the development of Methyl Anthranilate. In addition, NWRC is currently testing new experimental drugs that inhibit bird reproduction. NWRC scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

3.2.4 Community Based Decision Making

Technical assistance provided by Wildlife Services to resource owners for decision making. The WS program in Pennsylvania follows the "co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides technical assistance regarding the biology and ecology of waterfowl and effective, practical, and reasonable methods available to the local decision maker(s) to reduce wildlife damage. This includes non-lethal and lethal methods. WS and other state and federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available. Resource owners and others directly affected by waterfowl damage or conflicts in Pennsylvania have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Local decision makers decide which effective methods should be used to solve wildlife-related conflicts. These decision makers include community leaders, private property owners/managers, and public property owners/managers.

Community decision makers
The decision maker for the local community with a homeowner or civic association would be the President or the President's or Board's appointee. The President and Board are popularly elected residents of the local community who oversee the interests and business of the local community. This person would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision making. Identifying the decision maker for local business communities is more complex because the lease may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS would provide technical assistance to the local community or local business community decision maker(s) and recommendations to reduce damage. Direct control would be provided by WS if requested by the local community decision maker, funding provided, and the requested direct control was compatible with WS recommendations.

Private property decision makers
The decision maker for private property owned by one person is him or herself. WS would provide technical assistance to this person and recommendations to reduce damage. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations.

If no homeowner or civic association represents the affected resource then WS will provide technical assistance to the self or locally appointed decision maker. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations. Affected resource owners who disagree with the direct control action may request WS not conduct this action on their property and WS will honor this request.

Public property decision makers
The decision maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals and legal mandates for the property. WS would provide technical assistance to this person and recommendations to reduce damage. Direct control would be provided by WS if requested, funding provided, and the requested direct control was in line with WS recommendations.

Summary for community based decision making
The process for involving local communities and local stakeholders in the decisions for waterfowl damage management assures that local concerns are considered before individual damage management actions are taken.

3.2.5 Wildlife Damage Management Methods Available For Use or Recommendation by WS. (Appendix B contains detailed descriptions of waterfowl damage management methodologies)

Non-lethal methods

Property owner practices consist primarily of non-lethal preventive methods such as cultural methods[2] and habitat modification.

2 Generally involves modifications to the management of protected resources to reduce their vulnerability to wildlife damage

Animal behavior modification refers to tactics that alter the behavior of wildlife to reduce damages. Some but not all of these tactics include:

- Exclusion such as fencing/overhead wires
- Propane cannons (to scare waterfowl)
- Pyrotechnics (to scare waterfowl)
- Distress calls and sound producing devices (to scare waterfowl)
- Visual repellents and scaring tactics

Nest destruction of the target species before eggs or young are in the nest.

Habitat/environmental modification to attract or repel certain waterfowl species.

Live traps are various types of traps designed to capture waterfowl. Some examples are panel nets used for capturing waterfowl during the summer molt, rocket nets, clover traps, decoy traps, hand nets, etc.

Alpha-chloralose is used as an immobilizing agent, which is a central nervous system depressant, and used to capture waterfowl or other birds. It is generally used in recreational and residential areas, such as swimming pools, shoreline residential areas, golf courses, or resorts. Alpha-chloralose is typically delivered as a well-contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds.

Methyl Anthranilate (MA) (artificial grape flavoring food additive) has been shown to be an effective repellent for many bird species, including waterfowl. It can be applied to turf or surface water or as a fog to repel birds from small areas.

Anthraquinone is a chemical bird repellent that could be used to reduce feeding activity on airfields and other turf applications. Antraquinone is a bio-pesticide that is non-lethal and works by causing a negative response to feeding in the treated area (Avery et al. 1997).

Lethal Methods

Shooting is the selective removal of target species by shooting with an air rifle, shotgun, or rifle. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques.

Cervical dislocation is sometimes used to euthanize birds that are live captured. AVMA approves this technique as humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry and of small birds (Beaver et al. 2001).

Sport hunting is sometimes recommended when target species can be legally hunted.

Egg treatment/destruction is the practice of ceasing the development of the egg prior to hatching (egg oiling, chilling, shaking, puncturing); physically breaking eggs; or directly removing eggs from a nest and destroying them.

Carbon dioxide (CO_2) gas is an AVMA approved euthanasia method (Beaver et al. 2001) which is sometimes used to euthanize birds which are captured in live traps or by chemical immobilization and when relocation is not a feasible option. Live animals are placed in a container or chamber into which CO_2 gas is released. The animals quickly expire after inhaling the gas.

3.2.6 Examples of Past Waterfowl Damage Management Projects Conducted by PA WS

Nest/Egg Treatments: Geese typically lay one egg every 1-2 days for a total of 4-8 eggs/nest; the incubation period for goose eggs is approximately 28 days. Mallards typically lay between 8 and 10 eggs and the incubation period is between 26-30 days. Mute swans lay between 4-8 eggs and the incubation period is 35-38 days.

When PA WS has conducted waterfowl damage management projects in the past the procedure has included visiting the nests every 7-10 days for a 6-8 week period (last week of March to middle of May). WS treat only those eggs that are less than 14 days old. The typical egg treatment method conducted by PA WS is oiling. Oiling involves marking each egg, in the nest, and spreading a few drops of vegetable oil on the entire surface of the egg. The oiled eggs are returned to the nest until the completion of the project when they are removed and disposed of in accordance with state and federal laws. Nest/egg treatment projects are most commonly conducted in public recreation areas, golf courses, and industrial facilities.

Dog Harassment: When PA WS has conducted waterfowl damage management projects in the past, the procedure has included using border collies or Labradors to encourage waterfowl to leave an area. Dog harassment usually occurs after the nesting season but before post-nuptual molt then again after the molt and into the fall. Each site is visited three days a week. Dog harassment is only conducted in areas where egg treatment has been done in order to reduce the possibility of young being present during harassment. PA WS emphasizes dog harassment activities during the resident Canada goose hunting season.

Dog harassment is most effective in areas with no water bodies or with single, small (less than 2 acres) water bodies. This technique requires an ongoing program augmented with other waterfowl control techniques. Dog harassment projects are most commonly conducted in public recreation areas, golf courses, and industrial facilities.

Waterfowl Round-ups: When PA WS has conducted waterfowl damage management projects in the past, the procedure has included using panel nets or drive traps to capture geese during post-nuptual molt. Once the birds are in the traps they are humanely caught and transferred to waterfowl crates and then euthanized. In most situations adult geese are processed and then donated to a charitable food distribution organization. In cases where birds are available for

human consumption a percentage of the birds are tested for disease. All processed meat was packaged, frozen and stored at the processing site until test results were received. Head, kidney and liver samples are tested for exposure to organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals. Tests were conducted by the Pennsylvania Animal Diagnostic Laboratory System (PADLS) in Kennett Square, PA. The only situations where 100% of the birds are captured are airports and immediate health and human safety situations.

3.3 ALTERNATIVES ANALYZED IN DETAIL IN CHAPTER 4

3.3.1 Alternative 1: Integrated Wildlife Damage Management (Proposed Action/No Action)

The proposed action is for the WS program to continue the current IWDM program that responds to requests for waterfowl damage management to protect property, agricultural crops, natural resources, quality of life, human health, and human safety in Pennsylvania. Requests for assistance may occur anywhere and anytime in Pennsylvania. An IWDM approach would be implemented which would allow the use of legal techniques and methods, used singly or in combination, to meet requestor needs for reducing conflicts with waterfowl. Cooperators requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Non-lethal methods used by WS may include resource management, physical exclusion, and deterrents. Lethal methods used by WS may include nest and egg treatment/destruction, live capture and transportation to an approved poultry processing facility, live capture and euthanasia, and/or shooting. In many situations, the implementation of non-lethal methods such as habitat alteration, repellents, and exclusion type barriers would be the responsibility of the requestor to implement. Waterfowl damage management by WS would be allowed in Pennsylvania, when requested, on private property or public facilities where a need has been documented and, upon completion of an *Agreement for Control.* All management actions would comply with appropriate federal, state, and local laws.

3.3.2 Alternative 2: Technical Assistance Only by WS

This alternative would not allow for WS operational waterfowl damage management in Pennsylvania. WS would only provide technical assistance and make recommendations when requested. Producers, property owners, agency personnel, or others could conduct waterfowl damage management using any legal lethal or non-lethal method. Currently, alpha-chloralose is only available for use by WS employees. Therefore, use of this chemical by private individuals would be illegal and unavailable for use. Appendix B describes a number of methods that could be employed by private individuals or other agencies after receiving technical assistance advice under this alternative.

3.3.3 Alternative 3: Non-lethal Only by WS

This alternative would require WS to use or recommend non-lethal methods only to resolve waterfowl damage problems. Persons receiving technical assistance could still employ lethal methods that were available to them. Currently, alpha-chloralose is only available for use by WS employees. Therefore, use of this chemical by private individuals would be illegal. Appendix B describes a number of non-lethal methods available for use by WS under this alternative.

3.3.4 Alternative 4: No Federal WS Waterfowl Damage Management

This alternative would eliminate Federal involvement in waterfowl damage management in Pennsylvania. WS would not provide direct operational or technical assistance and requesters of WS services would conduct WDM without WS input. Information on waterfowl damage management methods may be available to producers and property owners through other sources such as USDA Agricultural Extension Service offices, universities, or pest control organizations. Alpha-chloralose is only available for use by WS employees. Therefore, use of this chemical by private individuals would be illegal and unavailable for use.

3.4 ALTERNATIVES ELIMINATED FROM FURTHER DISCUSSION WITH RATIONALE

3.4.1 Non-lethal Methods Implemented Before Lethal Methods

This alternative is similar to Alternative 1 except that WS personnel would be required to always recommend or use non-lethal methods prior to recommending or using lethal methods to reduce waterfowl damage. Both technical assistance and direct damage management would be provided in the context of a modified IWDM approach. Alternative 1, the Proposed Action, recognizes non-lethal methods as an important dimension of IWDM, gives them first consideration in the formulation of each management strategy, and recommends or uses them when practical before recommending or using lethal methods. However, the important distinction between the Non-lethal Methods First Alternative and the Proposed Alternative is that the former alternative would require that all non-lethal methods be used before any lethal methods are recommended our used.

While the humaneness of the non-lethal management methods under this alternative would be comparable to the Proposed Program Alternative 1, the extra harassment caused by the required use of methods that may be ineffective could be considered less humane. As local waterfowl populations increase, the number of areas negatively affected by these birds would increase, and greater numbers of birds would be expected to congregate at sites where non-lethal management efforts were not effective. This may ultimately result in a greater number of waterfowl being killed to achieve the local WAC than if lethal management were immediately implemented at problem locations (Manuwal 1989). Once lethal measures were implemented, waterfowl damage would be expected to drop relative to the reduction in localized population of waterfowl causing damage.

Since in many situations this alternative would result in greater numbers of waterfowl being killed to achieve the local WAC, at a greater cost to the requester, and result in a delay in reaching the local WAC in comparison to the Proposed Alternative, the Non-lethal Methods Implemented Before Lethal Methods Alternative is removed from further discussion in this document.

3.5 Mitigation and Standard Operating Procedures for Wildlife Damage Management Techniques

3.5.1 Mitigation in Standard Operating Procedures

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Pennsylvania, uses many such mitigation measures and these are discussed in detail in Chapter 5 of USDA (1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS's standard operating procedures include:

- The WS Decision Model would be used to identify effective wildlife damage management strategies and their impacts (Slate et al. 1992).
- Reasonable and prudent measures or alternatives would be identified through consultation with the USFWS and are implemented to avoid impacts to T&E species.

Some additional mitigating factors specific to the proposed program include:

- Management actions would be directed toward localized populations or groups of target species and/or individual offending members of those species.
- WS uses waterfowl damage management devices and conducts activities for which the risk of hazards to public safety and hazard to the environment have been determined to be low according to a formal risk assessment (USDA 1997, Appendix P). Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazard to the public is even further reduced.

3.5.2 Additional Mitigation Specific to the Issues

The following is a summary of additional mitigation measures that are specific to the issues listed in Chapter 2 of this document.

3.5.2.1 Effects on Target Species Populations

- Waterfowl damage management is directed to resolve waterfowl damage problems by taking action against individual problem birds, or local populations or groups, not by attempting to eradicate or reduce waterfowl populations in the entire area or region.
- To ensure that methods of live-capturing waterfowl result in minimal pain, which could be measured as physical injury (e.g., bleeding, broken wing), captured birds would be made as comfortable as possible by watering the birds as necessary, not overcrowding the birds if they are put in holding cages for transportation, and seeking shade for caged birds as necessary.
- WS take is monitored by comparing numbers of birds killed with overall populations or trends in populations.

3.5.2.2 Effects on Non-target Species Populations Including T&E Species

- WS personnel are trained and experienced to select the most appropriate method for taking problem animals and excluding non-target wildlife.
- Observations are made to determine if non-target or T&E species would be at significant risk from waterfowl damage management activities.
- WS has consulted with the USFWS regarding potential impacts of damage management methods on T&E species. WS abides by reasonable and prudent alternatives (RPAs) and/or reasonable and prudent measures (RPMs) established as a result of that consultation. For the full context of the Biological Opinion see Appendix F of USDA (1997).

4.0 CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. The chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis in Chapter 2. This section analyzes the environmental consequences of each alternative in comparison with the No Action alternative to determine if the real or potential effects would be greater, lesser, or the same.

The following resource values within the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

Cumulative Effects: Discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and non-target species, including threatened and endangered species.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

Effects on sites or resources protected under the National Historic Preservation Act: WS waterfowl damage management actions are not undertakings that could adversely affect historic resources (See Section 1.8.2.6).

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

4.1.1 Effects on Target Species Populations

Analysis of this issue is limited to those species killed during WS waterfowl damage management actions. The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997). Magnitude is described in USDA (1997) as "*. . . a measure of the number of animals killed in relation to their abundance.*" Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage.

4.1.1.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

A common concern among members of the public is whether wildlife damage management actions will adversely affect the viability of target species populations. WS maintains ongoing contact with USFWS and the PGC and submits annual migratory bird activity reports of

activities to both agencies. The USFWS monitors the total take of waterfowl from all sources and factors in survival rates from predation, disease, etc. Ongoing contact with USFWS and the PGC assures local, state and regional knowledge of wildlife population trends. While local populations of waterfowl may be reduced, compliance with applicable state and federal laws and regulations authorizing take of waterfowl and their nest and eggs, will ensure that the regional and statewide population will not be adversely affected. Canada geese, mallard ducks, mute swans, and domestic or feral waterfowl are the target species for analysis in this EA.

Resident Canada Geese

As described in Section 1.3, in 2002, the population of resident Canada geese in Pennsylvania was estimated to be approximately 234,700 geese. Cumulative impacts of the proposed action on resident Canada geese are based upon the anticipated WS take, hunter harvest, and authorized take by other (non-WS) entities (farmers, municipalities, homeowners associations, etc.). The potential take of resident Canada geese by WS is expected to have no negative cumulative impact on the statewide or flyway resident Canada goose population.

Since 1999, WS has taken (shot or capture and euthanized) a total of 1,031 resident Canada geese and 6,206 goose eggs (contained in 1225 nests) in PA (Table 7). Based upon past requests for WS assistance and an anticipated increase in future requests for services, WS anticipates that no more than 2.5% (5868 birds) of the resident goose population would likely be killed annually by WS in Pennsylvania under the proposed action. During the 2001 Early September and Late Winter Resident Canada goose hunting seasons the harvest of resident Canada geese in Pennsylvania was estimated at 63,700 and 18,900 geese, respectively (PGC 2002). For Federal Fiscal Year (FY) 2002 (October 2001 through September 2002), the USFWS issued 116 Depredation Permits to Pennsylvania entities other than WS, enabling the permitted take of up to 445 geese by capture and euthanize, 1,021 geese by shooting, and the destruction of up to 2,906 goose nests Using the 2001hunter harvest, USFWS permitted take, and WS anticipated kill of less than 2.5% of the population, the magnitude of WS impacts on the resident Canada goose population is considered to be very low. Furthermore this cumulative take would contribute positively to the PGC's and the AFC's goose population management objective of reduction from the current level (234,700 geese) to approximately 100,000 geese in Pennsylvania.

While local populations of resident Canada geese deemed above the WAC by the property owner or local community may be reduced, applicable state and federal laws and regulations authorizing take of Canada geese and their nest and eggs, including the USFWS and PGC permitting processes, would ensure that the statewide population would not be reduced below the state and Atlantic Flyway population goal of 100,000 resident Canada geese (Atlantic Flyway Council 1999).

Migratory Canada geese

As described in Section 1.3, in 2002, there were approximately 164,800 migratory Canada geese in Pennsylvania. Cumulative impacts of the proposed action on migratory Canada geese are based upon the anticipated WS take, hunter harvest, and authorized take by other (non-WS)

entities. The potential take of migratory Canada geese by WS is expected to have no negative cumulative impact on the statewide or flyway migratory Canada goose population.

Based upon past requests for WS assistance and an anticipated increase in future requests for services, WS anticipates that no more than 1/2% (824 birds) of the migratory Canada goose population would be killed by WS annually under the proposed action. During fiscal year 2002 (Oct. 2001-Sept. 2002), WS harvested 2 migratory Canada geese, however, it is possible that these may have been resident geese. During the 2001 regular Canada goose hunting season the estimated harvest for Pennsylvania was 43,100 geese (Person. Comm., J. Dunn, PGC, Dec. 2002). Geese harvested during this season effect both resident and migratory goose populations. Using the scenario that all geese harvested during this season are migratory geese and that WS anticipates taking no more than 1/2% of the population, the magnitude of WS impacts on the migratory Canada goose population is considered to be extremely low.

While local populations of migratory Canada geese deemed above the WAC by the landowner or local community may be reduced, applicable state and federal laws and regulations authorizing take of Canada geese, including the USFWS and the PGC permitting processes, under which management actions would be implemented would ensure that the statewide and flyway population would not be reduced below state and Atlantic Flyway population goals and objectives.

Mallard Ducks

As described in section 1.3, in 2002, there were an estimated 84,534 breeding mallard duck pairs in Pennsylvania with an estimated statewide total population of 171,752 ducks. Cumulative impacts of the proposed action on mallard ducks are based upon the anticipated WS take, hunter harvest, and authorized take by other (non-WS) entities. The potential take of mallard ducks by WS is expected to have no negative cumulative impact on the statewide or flyway mallard duck population.

Since 1999, WS has killed a total of (shot or capture/euthanize) 74 mallards and has taken a total of 172 eggs (contained in 21 nests) in PA (Table 4). Based upon past requests for WS assistance and an anticipated increase in future requests for services, WS anticipates that no more than 1/2% (859 birds) of the mallard population would be killed by WS annually under the proposed action. During the 2001 duck hunting season the estimated harvest for Pennsylvania was 63,400 mallard ducks (Person. Comm., J.Dunn, PGC, Dec. 2002). For Federal FY 2002, the USFWS issued Depredation Permits to Pennsylvania entities other than WS, enabling the authorized take of up to 65 mallards by shooting, and the destruction of up to 35 mallard nests. Using the 2001 hunter harvest, USFWS permitted take, and WS anticipated kill of less than 1/2% of the population, the magnitude of WS impacts on the mallard duck population is considered to be very low.

While local populations of mallard ducks deemed above the WAC by the local governing body may be reduced, applicable state and federal laws and regulations authorizing take of mallard ducks, including the USFWS and the PGC permitting processes, would ensure that the statewide

and flyway populations would not be reduced below state and Atlantic Flyway population goals and objectives.

Domestic and Feral Waterfowl

Based upon past requests for WS assistance and an anticipated increase in future requests for services, WS anticipates that the number of domestic and feral ducks killed or removed by WS could increase substantially above the current level of take. Since 1999, WS has taken a total of (shot or capture/euthanize) 193 domestic or feral waterfowl in PA (Table 7). However, domestic and feral waterfowl are non-indigenous species considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Any reduction, even to the extent of complete eradication from the natural environment, could be considered a beneficial impact to native waterfowl species. Domestic and feral waterfowl are considered invasive nuisance birds to the natural environment and are not protected by Pennsylvania state law or by federal law.

Mute Swans

As described in section 1.3, in 2002, the statewide mute swan population was estimated at 348 individuals. Cumulative impacts of the proposed action on mute swan populations are based upon the anticipated WS permitted take and authorized take by other (non-WS) entities. Biologically, the optimum mute swan population size for Pennsylvania is zero (Person. Comm., J. Dunn, PGC, December, 2002). Therefore, on state, federal, and other public lands the goal is zero mute swans. However, to accommodate sociological preferences for the presence of some mute swans, the goal for the rest of the state is to avoid any further population growth and maintain the total statewide population at a maximum of 250 birds (Person. Comm., J. Dunn, PGC, December, 2002). The potential take of mute swans by WS is expected to have no negative cumulative impact on the statewide or flyway mute swan populations.

Since 1999, WS has killed a total of (shot or capture/euthanize) 6 mute swans and has taken a total of 70 mute swan eggs (contained in 10 nests) in PA (Table 7). Based upon past requests for WS assistance and an anticipated increase in future requests for services, WS anticipates that no more than 75 mute swans would be killed by WS on an annual basis in PA. In Federal fiscal year 2002, there were no mute swans taken by non-WS entities. Currently there are no hunting seasons for mute swans in PA

While local populations of mute swans deemed above the WAC by the local governing body may be reduced, applicable state and federal laws and regulations authorizing take of mute swans would ensure that the statewide and flyway populations would not be reduced below state and Atlantic Flyway population goals and objectives.

Table 7. Number of Canada geese, mallards, domestic or feral waterfowl, and mute swans and nests and goose eggs taken by USDA APHIS Wildlife Services in Pennsylvania during Federal Fiscal Years 1999-2002. Take was conducted pursuant to federal and state authorities, such as depredation permits.

Fiscal Year	Number of Geese	Number of Mallards	Number of domestics/ferals	Number of mute swans
1999	47	0	7	1
2000	154	5	48	0
2001	189	12	93	3
2002	641	57	47	2
Total	1031	74	195	6

Fiscal Year	Number of geese eggs*/nests	Number of mallard eggs*/nests	Number of Domestic/feral eggs*/nests	Number of mute swan eggs*/nests
1999	1072/217	0	0	0
2000	512/98	0	66/4	0
2001	1454/277	34/7	0	0
2002	3168/633	138/14	38/3	70/10
Total	6206/1225	172/21	104/7	70/10

*Take of eggs does not have the same management implications as the take of adult birds. These numbers are presented to fully disclose take of adult birds and nests/eggs by WS during 1999-2002.

4.1.1.2 Alternative 2: Technical Assistance Only by WS

Under this alternative, WS would have no impact on target waterfowl populations in Pennsylvania because the WS program would not conduct any waterfowl population management activities and would provide advice only. Private efforts to reduce or prevent waterfowl damage and conflicts could increase, which could result in similar or even greater effects on those populations than the current program alternative. For the same reasons shown in the population effects analysis in Section 4.1.1.1, however, it is unlikely that target waterfowl populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemicals which could lead to real but unknown effects on waterfowl populations. The tranquilizer alpha-chloralose is currently only available for use by WS employees and would not be available for use under this alternative. Effects and hypothetical risks of illegal killing of waterfowl under this alternative would probably be about the same as those under Alternative 3.

4.1.1.3 Alternative 3: Non-Lethal Only By WS

Under this alternative, WS would not take any target species because no lethal methods would be used. Although WS lethal take of waterfowl would not occur, it is likely that, without WS conducting some level of lethal waterfowl damage management activities for these species, private waterfowl damage management efforts would increase, leading to potentially similar or even greater effects on target species populations than those of the current program alternative. For the same reasons shown in the population effects analysis in section 4.1.1.1, however, it is

unlikely that target waterfowl populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on target waterfowl populations. Effects and hypothetical risks of illegal killing of waterfowl under this alternative would probably be less than Alternative 4.

4.1.1.4 Alternative 4: No Federal WS Waterfowl Damage Management

Under this alternative, WS would have no impact on waterfowl populations in Pennsylvania. Private efforts to reduce or prevent damage and conflicts could increase, which could result in effects on target species populations to an unknown degree. Effects on target species under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by private persons. For the same reasons shown in the population effects analysis in Section 4.1.1.1 it is unlikely that target waterfowl populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of waterfowl and therefore could lead to real but unknown effects on target waterfowl populations. The tranquilizer alpha-chloralose is currently only available for use by WS employees and would not be available for use under this alternative.

4.1.2 Effectiveness of Waterfowl Damage Management

4.1.2.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

This alternative would be more effective than any of the other alternatives in reducing or minimizing damage caused by waterfowl. Population limiting techniques (e.g., hunting, capture and euthanize, shooting, and nest/egg destruction) may have long-term effects and can slow population growth or even reduce the size of a waterfowl population (Cooper and Keefe 1997). This alternative would give WS the option to implement lethal management in response to human health and safety concerns and damage to property and other resources. This alternative would enhance WS effectiveness and ability to address a broader range of damage problems. Repopulation of sites where lethal management methods were used would undoubtedly take place as long as suitable habitat exists in that area. However, the use of lethal management would reduce the number of damaging waterfowl thereby enhancing the effectiveness of non-lethal methods (Smith et al. 1999). Kilpatrick and Walter (1999) reported that when an urban wildlife population above the WAC is reduced through lethal means, many residents subsequently experience reduced damage.

This alternative would likely reduce the potential for bird-aircraft collisions at airports and increase human safety. This has been demonstrated by Cooper (1991) who reported the removal of geese posing or likely to pose a hazard to air safety at airports considerably reduced the population of local geese, decreased the number of goose flights through airport operations airspace, and significantly reduced goose-aircraft collisions at Minneapolis-St. Paul International Airport. In addition, Dolbeer et al. (1993) demonstrated that an integrated approach (including removal of offending birds) reduced bird hazards at airports and substantially reduced bird

collisions with aircraft by as much as 89%. Jensen (1996) also reported that an IWDM approach that incorporated removal of geese, reduced goose-aircraft collisions by 80% during a 2 year period.

This alternative would also be more effective than Alternatives 2 or 3, which rely primarily on frightening or displacing waterfowl from one location to another.

4.1.2.2 Alternative 2: Technical Assistance Only by WS

With WS technical assistance but no direct management, entities requesting waterfowl damage management would either take no action, which means conflicts and damage would likely continue or increase in each situation as bird numbers are maintained or increased, or implement WS recommendations for non-lethal and lethal control methods. Methods of frightening or discouraging waterfowl have been effective at specific sites. In most instances however, these methods have simply shifted the problem elsewhere (Conover 1984, Aguilera et al. (1991), and Swift 1998). Of the non-lethal techniques commonly used by the public to reduce conflicts with waterfowl (e.g., feeding ban, habitat modification, live swan, Methyl Anthranilate, fencing, harassment with dogs, people or vehicles), only fencing was reported to have been highly effective (Cooper and Keefe 1997). Habitat modifications, while potentially effective, are poorly accepted, not widely employed, and many include reducing water levels in wetlands and are not biologically sound. Long-term solutions usually require some form of local population reduction to stabilize or reduce waterfowl population size (Smith et al. 1999). Waterfowl population reduction would be limited to applicable state and federal laws and regulations authorizing take of waterfowl, including legal hunting and take pursuant to Depredation Permits. However, individuals or entities that implement lethal management may not have the experience necessary to efficiently and effectively conduct the actions.

4.1.2.3 Alternative 3: Non-Lethal Only By WS

Under this alternative, WS would be restricted to implementing and recommending only non-lethal methods in providing assistance with waterfowl damage problems. The success or failure of the use of non-lethal methods can be quite variable. Methods of frightening or discouraging waterfowl have been effective at specific sites. In most instances however, these methods have simply shifted the problem elsewhere (Conover 1984, Aguilera et al. 1991, and Swift 1998). However, if WS is providing direct operational assistance in dispersing waterfowl, coordination with local authorities, who may assist in monitoring the birds' movements, is generally conducted to assure they do not reestablish in other undesirable locations. Of the non-lethal techniques commonly used by the public to reduce conflicts with waterfowl (e.g., feeding ban, habitat modification, live swan, Methyl Anthranilate, fencing, harassment with dogs, people or vehicles), only fencing was reported to have been highly effective (Cooper and Keefe 1997). Habitat modifications, while potentially effective, are poorly accepted, not widely employed, and many include reducing water levels in wetlands and are not biologically sound. Long-term solutions usually require some form of local population reduction to stabilize or reduce waterfowl population size (Smith et al. 1999). Overall impacts would be similar to Alternative 2.

4.1.2.4 Alternative 4: No Federal WS Waterfowl Damage Management.

With no WS assistance, private individuals and community government officials would either take no action, which means the waterfowl damage and conflicts would likely continue or increase in each situation as waterfowl numbers are maintained or increased, or implement their own non-lethal and lethal control methods. Impacts would be variable and dependent upon the actions taken by non-WS personnel.

4.1.3 Effects on Aesthetic Values

Effects on Human Affectionate-Bonds With Individual Birds and On Aesthetics

4.1.3.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Some people who routinely view or feed individual geese, ducks, or domestic waterfowl would likely be disturbed by removal of such birds under the proposed program. People who have developed affectionate bonds with individual birds may feel sadness and anger if those particular birds were removed. WS is aware of such concerns and takes this into consideration to mitigate these affects. WS might sometimes be able to mitigate such concerns by leaving certain birds which might be identified by interested individuals.

Some people have expressed opposition to the killing of any waterfowl during waterfowl damage management activities. Under the current program, some lethal control of birds would continue and these persons would continue to be opposed. However, many persons who voice opposition have no direct connection or opportunity to view or enjoy the particular birds that would be killed by WS's lethal control activities. Lethal control actions would generally be restricted to local sites and to small percentages of overall waterfowl populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant and would therefore continue to remain available for viewing by persons with that interest.

Lethal removal of waterfowl from airports should not affect the public's enjoyment of the aesthetics of the environment since airport properties are closed to the public. The ability to view and interact with waterfowl at these sites is usually either restricted to viewing from a location outside boundary fences, or is forbidden.

4.1.3.2 Alternative 2: Technical Assistance Only by WS

Under this alternative, WS would not conduct any direct management, would still provide technical assistance or self-help advice to persons requesting assistance with waterfowl damage. WS would also not conduct any harassment of waterfowl that were causing damage. Some people who oppose direct management assistance in wildlife damage management by the government but favor government technical assistance would favor this alternative. Persons who have developed affectionate bonds with individual birds would not be affected by WS's activities under this alternative because the individual birds would not be killed by WS. However, other private entities would likely conduct direct management assistance activities similar to those that

would no longer be conducted by WS, and the effects would then be similar to the proposed action alternative.

4.1.3.3 Alternative 3: Non-Lethal Only By WS

Under this alternative, WS would not conduct any lethal wildlife damage management but would still conduct harassment of waterfowl that were causing damage. Some people who oppose lethal control of wildlife by the government but are tolerant of government involvement in non-lethal wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual birds would not be affected by the death of individual birds under this alternative, but might oppose dispersal or translocation of certain birds. As discussed in this Subsection under Alternative 1, WS might sometimes be able to mitigate such concerns by leaving certain waterfowl which might be identified by interested individuals. In addition, the abundant populations of target waterfowl species in urban-suburban environments would enable people to continue to view them and to establish affectionate bonds with individual birds. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct waterfowl damage management activities similar to those that would no longer be conducted by WS, and the effects would then be similar to the proposed action alternative.

4.1.3.4 Alternative 4: No Federal WS Waterfowl Damage Management.

Under this alternative, WS would not conduct any lethal removal of waterfowl nor would the program conduct any harassment of birds. Some people who oppose any government involvement in wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual birds would not be affected by WS's activities under this alternative. However, other private entities would likely conduct waterfowl damage management activities similar to those that would no longer be conducted by WS, and the effects would then be similar to the proposed action alternative.

Effects On Aesthetic Values of Property Damaged by Birds

4.1.3.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Under this alternative, operational assistance in reducing waterfowl conflicts, in which feces from the birds accumulate, would improve aesthetic values of affected properties. In addition, individuals whose aesthetic enjoyment of other birds and the environment is diminished by the presence of waterfowl and waterfowl feces will be positively affected by programs which result in reductions in the presence of waterfowl.

The dispersal of waterfowl by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in dispersing such birds, coordination with local authorities, who may assist in monitoring the birds' movements, may be conducted to assure they do not reestablish in other undesirable locations.

4.1.3.2 Alternative 2: Technical Assistance Only by WS

Under this alternative, the lack of operational assistance in reducing waterfowl problems could result in an increase of potential adverse affects on aesthetic values. However, potential adverse affects would likely be less than those for Alternative 4, since WS would be providing technical assistance.

The dispersal of waterfowl by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. If WS has only provided technical assistance to local residents or municipal authorities, coordination with local authorities to monitor the birds' movements to determine if birds become established in other undesirable locations may not be conducted, therefore increasing the potential of adverse effects to nearby property owners.

4.1.3.3 Alternative 3: Non-Lethal Only By WS

Under this alternative, WS would be restricted to non-lethal methods only. Assuming property owners would choose to allow and pay for the implementation of these non-lethal methods, this alternative could result in waterfowl relocating to other sites where they would likely create or worsen similar problems for other property owners. Thus, this alternative would likely result in more property owners experiencing adverse effects on the aesthetic values of their properties than the proposed action alternative.

The dispersal of waterfowl by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in dispersing such birds, coordination with local authorities, who may assist in monitoring the birds' movements, may be conducted to determine if they become established in other undesirable locations.

4.1.3.4 Alternative 4: No Federal WS Waterfowl Damage Management.

Under this alternative, the lack of any operational or technical assistance in reducing waterfowl problems would mean aesthetic values of some affected properties would continue to be adversely affected if the property owners were not able to reduce waterfowl damage in some other way. In many cases, this type of aesthetic "damage" would worsen because property owners would not be able to resolve their problems and waterfowl numbers would continue to increase.

The dispersal of waterfowl by harassment and barriers can sometimes result in the birds causing the same or similar problems at the new location. Coordination with local authorities to monitor waterfowl movements, to determine if birds become established in other undesirable locations, might not be conducted, therefore increasing the potential of adverse effects to nearby property owners.

4.1.4 Humaneness and Animal Welfare Concerns of Lethal Methods Used by WS

4.1.4.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

Under this alternative, methods viewed by some persons as inhumane would be used by WS. These methods would include capture and euthanasia, capture and processing for human consumption, immobilization with the use of AC, and shooting.

Many stakeholders would want waterfowl captured in a way that results in no pain or a minimization of pain, which they could measure as physical injury (e.g., bleeding, broken wing). Captured birds would be made as comfortable as possible by watering the birds as necessary, not overcrowding the birds if they are put in holding crates for transportation, and seeking shade for caged birds as necessary.

There would likely be concern among stakeholders, in situations where waterfowl are captured and processed for human consumption, that the birds should be killed quickly. Birds would be processed for human consumption in state licensed poultry processing facilities in accordance with all pertinent regulations.

There may be concern among stakeholders that birds sedated with AC should not be allowed to drown, even if the birds are to be euthanized. If waterfowl are shot, stakeholders would likely want quick clean kills of shot birds. Some persons would view shooting as inhumane. In situations where waterfowl are being captured alive by use of nets or by hand, the birds would be euthanized by methods approved by the AVMA (Beaver et al. 2001). Most people would view AVMA-approved methods of euthanizing animals as humane.

Some people could also be concerned about eggs being oiled, punctured, chilled, or addled. A minority of stakeholders would likely want no waterfowl captured, harassed, or killed because they consider putting birds in crates as inhumane, and the killing of birds as inhumane regardless of the method used.

Some people have concerns over the potential for separation of waterfowl family groups through management actions. This could occur through harassment (e.g., pyrotechnics, dogs) and lethal control methods. However, it is not uncommon for waterfowl family units to experience change. Bellrose (1980) cites several sources which list annual mortality rates of juvenile waterfowl ranging from 7 to 19% during the hatching to fledgling stage. Biologists believe that juvenile birds have a good likelihood of survival without adult birds once the juvenile reaches fledgling stage, which occurs by July for most juvenile birds. Therefore, molting juvenile waterfowl that escape capture would most likely survive to adulthood (Mississippi Flyway Council Technical Section 1996). Separated adults form new pair bonds and readily breed with new mates (Moser et al. 1991).

4.1.4.2 Alternative 2: Technical Assistance Only by WS

Under this alternative, WS would not conduct any lethal or non-lethal management actions, and would provide self-help advice only. Thus, lethal methods viewed as inhumane by some persons would not be used by WS. Without WS direct management assistance, it is expected that many people experiencing waterfowl damage would reject non-lethal recommendations or would not be willing to pay the extra cost of implementing and maintaining them, and would seek to implement lethal means. Overall, impacts on humaneness and animal welfare concerns associated with waterfowl damage management under this alternative would likely be similar to the proposed action alternative.

4.1.4.3 Alternative 3: Non-Lethal Only By WS

Under this alternative, lethal methods viewed as inhumane by some persons would not be used by WS. However, it is expected that many requesters of waterfowl damage management assistance would reject non-lethal methods recommended by WS and/or would not be willing or able to pay the extra cost of implementing and maintaining them and would seek to implement lethal means. Overall impacts would be similar to Alternative 1.

4.1.4.4 Alternative 4: No Federal WS Waterfowl Damage Management

Under this alternative, methods viewed as inhumane by some persons would not be used by WS. Lethal methods could be used by non-WS entities and, similar to the proposed action alternative, would be viewed by some persons as inhumane. Overall, waterfowl damage management under this alternative would likely be similar to the proposed action alternative.

4.1.5 Effects on Non-target Wildlife Species Populations, Including T&E Species

4.1.5.1 Alternative 1: Integrated Wildlife Damage Management Program (Proposed Action/No Action)

WS, other wildlife professionals, and the public are concerned with the impact of damage management methods and activities on non-target species, especially threatened and endangered (T&E) species. WS's standard operating procedures include measures intended to mitigate or reduce the effects on non-target species populations and are presented in Chapter 3. WS has not killed any non-target wildlife species while conducting waterfowl damage management activities in Pennsylvania and does not anticipate this number to substantially increase.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. Lists of State and Federal T&E species were obtained from the PGC, DCNR and the USFWS (Appendix C). WS has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of waterfowl damage management methods on T&E species and has obtained a Biological Opinion (USDI 1992). For the full context of the Biological Opinion, see Appendix F of the ADC Final EIS (USDA 1997, Appendix F). Based on the conclusions made by USFWS during their 1992 programmatic consultation of WSs activities and subsequent Biological Opinion, it was determined that management activities being utilized for waterfowl damage management in Pennsylvania are not likely to adversely affect the T&E species listed in

Pennsylvania. Furthermore, the Pennsylvania WS program has determined no effect on those T&E species not included in the 1992 B.O. (Bog turtle (*Clemmys muhlenbergii*), Clubshell mussel (*Pleurobema clava*), Northern riffleshell (*Epioblasma torulosa rangiana*), and Northeastern bulrush (*Scirpus ancistrochaetus*)) and that the use of alpha-chloralose by WS employees or persons under their direct supervision will have no effect on any federally listed T&E species in Pennsylvania.

WS abides by laws and regulations of the MBTA regarding migratory birds (50 CFR§21). Non-target migratory bird species and other wildlife species are usually not affected by WS's management methods, except for the occasional scaring from harassment devices. In these cases, migratory birds and other affected wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action.

Non-lethal chemical products that might be used or recommended by WS would include repellents such as methyl or di-methyl anthranilate (artificial grape flavoring used in foods and soft drinks sold for human consumption), which has been used as an area repellent, anthraquinone, and the tranquilizer drug alpha-chloralose. Such chemicals have undergone rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or FDA. Any operational use of chemical repellents would be in accordance with labeling requirements under FIFRA and State pesticide laws and regulations which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on wildlife populations.

Based on a thorough Risk Assessment, APHIS concluded that, when chemical methods are used by WS in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible effects on the environment (USDA 1997).

4.1.5.2 Alternative 2: Technical Assistance Only by WS

Alternative 2 would not allow any WS direct operational waterfowl damage management in Pennsylvania. There would be no impact on non-target or T&E species by WS activities from this alternative. Technical assistance or self-help information would be provided upon request. Although technical support might lead to more selective use of control methods by private individuals than that which might occur under Alternative 4, private efforts to reduce or prevent depredations could still result in less experienced persons implementing control methods leading to greater take of non-target wildlife than under the Proposed Action. It is possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of waterfowl, which could lead to unknown effects on local non-target species populations, including some T&E species. Hazards to raptors, including bald eagles and falcons, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

4.1.5.3 Alternative 3: Non-Lethal Only By WS

Under this alternative, WS take of non-target animals would hypothetically be less than that of the proposed action because no lethal control actions would be taken by WS. However, non-target take would not differ substantially from the proposed/current program because the current program has taken no non-target animals. On the other hand, people whose waterfowl damage problems were not effectively resolved by non-lethal control methods would likely resort to other means of lethal control such as use of shooting by private persons or even illegal use of chemical toxicants. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of waterfowl which could lead to unknown effects on local non-target species populations, including T&E species. Hazards to raptors, including bald eagles and falcons, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals. Potential impacts of WS use of non-lethal chemicals would be similar to the proposed action.

4.1.5.4 Alternative 4: No Federal WS Waterfowl Damage Management.

Alternative 4 would not allow any WS waterfowl damage management in Pennsylvania. There would be no impact on non-target or T&E species by WS activities from this alternative. However, private efforts to reduce or prevent depredations could increase, which could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than under the proposed action. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal killing of waterfowl which could impact local non-target species populations, including some T&E species. Hazards to raptors, including bald eagles and peregrines, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

4.2 CUMULATIVE IMPACTS

Cumulative impacts are impacts on the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts of public actions to reduce waterfowl damage in the absence of WS assistance (Alternative 4) can only be speculated. Similarly, cumulative impacts of public actions to reduce waterfowl damage in the absence of WS direct damage management assistance (Alternative 2) can only be speculated. However, it is reasonable to expect that as governmental assistance in resolving wildlife conflicts decreases, independent actions increase. The environmental desirability of these actions would be dependent upon the individuals who implement them. Many such actions would be poorly monitored, and public accountability would likely be low. For these reasons, cumulative impacts to the environment may be expected to increase as WS assistance decreases.

No significant cumulative environmental impacts are expected from any of the 4 alternatives. Under the Proposed Action, including the lethal removal of waterfowl by WS, would not have a

significant impact on overall resident or migratory waterfowl populations in Pennsylvania or the Atlantic Flyway, but some local reductions may occur. Although some persons will likely be opposed to WS participation in waterfowl damage management activities, the analysis in this EA indicates that the proposed WS Integrated waterfowl damage management program will not result in significant cumulative adverse impacts on the quality of the human environment. Table 8 summarizes the expected impacts of the alternatives on each of the issues.

Table 8. Summary of the expected impacts of each of the alternatives on each of the issues related to waterfowl damage management by WS in Pennsylvania.

Issues	*Alternative 1 Current Program/No Action- Integrated Wildlife Damage Management Program*	*Alternative 2 Technical Assistance Only by WS*	*Alternative 3 Nonlethal Only by WS*	*Alternative 4 No Federal WS Waterfowl Damage Management Program*
Target Species Effects	*Low effect - reductions in local waterfowl numbers; would not significantly affect state and flyway populations.*	*Low effect - reductions in local waterfowl numbers by non-WS personnel likely; would not significantly affect state and flyway populations.*	*Low effect - reductions in local waterfowl numbers by non-WS personnel likely; would not significantly affect state and flyway populations.*	*Low effect - reductions in local waterfowl numbers by non-WS personnel likely; would not significantly affect state and flyway populations.*
Effectiveness of WDM	*The proposed action has the greatest potential of successfully reducing waterfowl conflicts and damage*	*Impacts could be similar or less than the proposed action dependent upon action taken by non-WS personnel.*	*Impacts could be similar or less than the proposed action dependent upon action taken by non-WS personnel.*	*Impacts could be similar or less than the proposed action dependent upon action taken by non-WS personnel.*

Aesthetic Enjoyment of waterfowl	*Low to moderate effect at local levels; Some local populations may be reduced; WS waterfowl damage management activities do not adversely affect overall regional or state waterfowl populations.*	*Low to moderate effect. Local waterfowl numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state waterfowl populations.*	*Low to moderate effect. Local waterfowl numbers in damage situations would remain high or possibly increase when non-lethal methods are ineffective unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state waterfowl populations.*	*Low to moderate effect. Local waterfowl numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state waterfowl populations.*
Aesthetic Damage Caused by Waterfowl	*Low effect - waterfowl damage problems most likely to be resolved without creating or moving problems elsewhere.*	*Moderate to High effect - waterfowl may move to other sites which can create aesthetic damage problems at new sites.*	*Moderate to High effect - waterfowl may move to other sites which can create aesthetic damage problems at new sites. Less likely than Alt. 2 and 4.*	*High effect - nuisance waterfowl problems less likely to be resolved without WS involvement. waterfowl may move to other sites which can create aesthetic damage problems at new sites*
Humaneness Concerns of Methods Used by WS	*Low to moderate effect - methods viewed by some people as inhumane would be used by WS*	*No effect by WS. Impacts by non-WS personnel would be variable.*	*Lower effect than Alt. 1 since only non-lethal methods would be used by WS*	*No effect by WS.* *Impacts by non-WS personnel would be variable.*
Effects on Other Wildlife Species, Including T&E Species	*Low effect - methods used by WS would be highly selective with very little risk to non-target species.*	*No effect by WS.* *Impacts by non-WS personnel would be variable.*	*Low effect - methods used by WS would be highly selective with very little risk to non-target species.*	*No effect by WS.* *Impacts by non-WS personnel would be variable.*

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APPENDIX A

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APPENDIX B

Waterfowl Damage Management Methods Available for Use or Recommended by the Pennsylvania Wildlife Services Program

The most effective approach to resolving wildlife damage problems is to integrate the use of several methods, either simultaneously or sequentially. Integrated Wildlife Damage Management (IWDM) would integrate and apply practical methods of prevention and reduce damage by wildlife while minimizing harmful effects of damage reduction measures on humans, other species, and the environment. IWDM may incorporate resource management, physical exclusion and deterrents, and population management, or any combination of these, depending on the characteristics of specific damage problems.

In selecting damage management techniques for specific damage situations, consideration is given to the responsible species and the magnitude, geographic extent, duration and frequency, and likelihood of wildlife damage. Consideration is also given to the status of target and potential non-target species, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. These factors are evaluated in formulating damage management strategies that incorporate the application of one or more techniques.

A variety of methods are potentially available to the WS program in Pennsylvania relative to the management or reduction of damage from waterfowl. WS develops and recommends or implements IWDM strategies based on resource management, physical exclusion and wildlife management approaches. Within each approach there may be available a number of specific methods or tactics.

Various federal, state, and local statutes and regulations and WS directives govern WS use of damage management tools and substances. The following methods and materials are recommended or used in technical assistance and direct damage management efforts of the WS program in Pennsylvania. The effectiveness of the program can be defined in terms of reduced economic losses, decreased health hazards, minimized property damage and improved quality of life.

RESOURCE MANAGEMENT

Resource management includes a variety of practices that may be used by resource owners to reduce the potential for wildlife damage. Implementation of these practices is appropriate when the potential for damage can be reduced without significantly increasing a resource owner's costs or diminishing his/her ability to manage resources pursuant to goals. Resource management recommendations are made through WS technical assistance efforts.

Habitat Alteration: Habitat alteration can be the planting of vegetation unpalatable to wildlife or altering the physical habitat (Conover and Kania 1991, Conover 1992). Conover (1991[a],

1991[b]) found that even hungry Canada geese refused to eat some ground covers such as common periwinkle (*Vinca minor*), English ivy (*Hedera helix*) and Japanese pachysandra (*Pachysandra terminalis*). Planting less preferred plants or grasses to discourage geese from a specific area could work more effectively if good alternative feeding sites are nearby (Conover 1985). However, the manipulation of turf grass varieties in urban/suburban, heavy use situations such as parks, athletic fields and golf courses is often not feasible. Varieties of turf grass that grow well and can withstand regular mowing and regular/heavy human use include: Kentucky blue grass, red fescue, perennial bent grass, perennial rye grass and white clover. All of these grasses are appealing to most waterfowl. The turf grass varieties that are not appealing to some waterfowl such as, tall fescue, orchard grass and timothy, do not withstand regular mowing and/or regular/heavy human use.

Fences, hedges, shrubs, boulders, etc. can be placed at shorelines to impede waterfowl movements. Restricting a bird's ability to move between water and land will deter them from an area, especially during molts (Gosser et al. 1997). However, people are often reluctant to make appropriate landscape modifications to discourage waterfowl activity (Breault and McKelvey 1991, Conover and Kania 1991). Unfortunately, both humans and waterfowl appear to find lawn areas near water attractive (Addison and Amernic 1983, Cooper[a] In Press), and conflicts between humans and waterfowl will likely continue wherever this interface occurs. Cooper (1998) reported that 93% of current shoreline turf, in the Twin Cities metropolitan area, would be needed to be modified to limit the goose population to established goals, and this approach may be unacceptable to the human residents. To limit the resident goose population size in the Twin Cities region of Minnesota, Cooper (1998) estimated costs of modifying habitat at $33.9 million for tall grass prairie and $1.8 billion for ground juniper (*Juniperus spp.*). Therefore, he concluded that shoreline habitat modification as a population management tool would be prohibitively expensive.

Removal of water bodies would likely reduce the attractiveness of an area to waterfowl. Urban/suburban waterfowl tend to feed near bodies of water with a distant view over short grass (Conover and Kania 1991). Draining/removal of water bodies are considered unreasonable and aesthetically unacceptable. The draining of wetlands is strictly regulated and must be permitted by the U.S. Army Corps of Engineers and the Department of Environmental Protection.

Lure Crops: Lure crops are food resources planted to attract wildlife away from more valuable resources (e.g., crops). This method is largely ineffective for urban waterfowl since food (turf) resources are readily available. For lure crops to be effective, the ability to keep birds from surrounding fields would be necessary, and the number of alternative feeding sites must be minimal (Fairaizl and Pfeifer 1988). Additionally, lure crops reduce damage for only a short time (Fairaizl and Pfeifer 1988) and damage by waterfowl is generally continuous. The resource owner is limited in implementing this method contingent upon ownership of, or otherwise ability to manage the property. Unless the original waterfowl-human conflict is resolved, creation of additional waterfowl habitat could increase future conflicts.

Lure crops may be planted on some land held in private ownership, such as conservation clubs, throughout Pennsylvania. These plantings may provide some additional food or act as an attractant for waterfowl. However, it is highly unlikely they contribute to conflicts with waterfowl or act as significant waterfowl attractants.

Modify Human Behavior: Artificial feeding of waterfowl by people attracts and sustains more birds in an area than could be supported by natural food supplies. This unnatural food source exacerbates damage by waterfowl. The elimination of feeding of waterfowl is a primary recommendation made by WS, and many local municipalities and homeowners associations have adopted policies and ordinances prohibiting it. Some parks have posted signs, and there have been efforts made to educate the public on the negative aspects of feeding waterfowl. However, sometimes people do not comply, and the policies are poorly enforced in some areas.

Alternatively, some entities do not prohibit the feeding of waterfowl because the waterfowl population in the location has not exceeded the WAC. It is unlikely that the feeding of waterfowl in these locations would significantly contribute to conflicts with waterfowl in other communities or locations.

Alter Aircraft Flight Patterns: In cases where the presence of waterfowl at airports results in threats to human safety, and when such problems cannot be resolved by other means, the alteration of aircraft flight patterns or schedules may be recommended. However, altering operations at airports to decrease the potential for hazards is not feasible unless an emergency situation exists. Otherwise, the expense of interrupted flights and the limitations of existing facilities make this practice prohibitive.

Removal of Domestic Waterfowl: Flocks of urban waterfowl are known to act as decoys and attract migrating waterfowl (Crisley et al. 1968, Woronecki 1992, AAWV undated). Rabenold (1987) and Avery (1994) reported that birds learn to locate food resources by watching the behavior of other birds. The removal of domestic waterfowl from ponds removes birds that act as decoys in attracting other waterfowl. Domestic and feral waterfowl could also carry diseases which threaten wild populations. Property or resource owners may be reluctant to remove some or all decoy birds because of the enjoyment of their presence.

PHYSICAL EXCLUSION AND DETERRENTS

Physical exclusion and deterrents restrict the access of wildlife to resources and/or alter behavior of target animals to reduce damage. These methods provide a means of appropriate and effective prevention of waterfowl damage in many situations.

Electric Fence: The application of electrified fencing is generally limited to rural settings, due to the possibility/likelihood of electricity interacting with people and pets. Limits of this application arise where there are multiple landowners along the wetland, pond, or lake, and the size of the field and its proximity to bodies of water used by waterfowl. Perceptions from Minnesota on the effectiveness of electric fences were high (Cooper and Keefe 1997). While electric fencing may be effective in repelling waterfowl in some urban settings, its use is often

prohibited in many municipalities for human safety reasons. Problems that typically reduce the effectiveness of electric fences include; vegetation on fence, flight capable waterfowl, fencing knocked down by other animals (e.g., white-tailed deer and dogs), and poor power.

Barrier Fence: The construction or placement of physical barriers has limited application for waterfowl. Barriers can be temporary or permanent structures. Lawn furniture/ornaments, vehicles, boats, snow fencing, plastic hazard fencing, metal wire fencing, and multiple strand fencing have all been used to limit the movement of waterfowl. Perceptions from Minnesota indicate that permanent barriers were highly effective, while temporary barriers were moderately effective (Cooper and Keefe 1997). The application of this method is limited to areas that can be completely enclosed and do not allow waterfowl to land inside enclosures. Similar to most abatement techniques, this method has been most effective when dealing with small numbers of breeding waterfowl and their flightless young along wetlands and/or waterways. Unfortunately, there have been situations where barrier fencing designed to inhibit waterfowl nesting has entrapped young and resulted in starvation (Cooper 1998).

The preference for waterfowl to walk or swim, rather than fly, during this time period contributes to the success of barrier fences. Waterfowl that are capable of full or partial flight render this method useless, except for enclosed areas small enough to prevent landing. However, site specific habitat alterations have merit, provided that landscape designs are based on biological diversity and human safety objectives (Cooper[b] In Press). To limit the goose population size in the Twin Cities region of Minnesota with wire fences, Cooper (1998) estimated it would cost $12.3 million for 25 years.

Surface Coverings: Waterfowl may be excluded from ponds using overhead wire grids (Fairaizl 1992, Lowney 1993). Overhead wire grids have been demonstrated to be most applicable on ponds $\leq$ two acres, but wire grids may be considered aesthetically unappealing to some people. Wire grids render a pond unusable for boating, swimming, fishing, and other recreational activities. Installation costs are about $1,000 per surface acre for materials. The expense of maintaining wire grids may be burdensome for some people.

Balls approximately five inches in diameter can be used to cover the surface of a pond. A "ball blanket" renders a pond unusable for boating, swimming, fishing, and other recreational activities. This method is very expensive, costing about $131,000 per surface acre of water.

Visual Deterrents: Reflective tape has been used successfully to repel some birds from crops when spaced at three to five meter intervals (Bruggers et al. 1986, Dolbeer et al. 1986). Mylar flagging has been reported effective at reducing migrant Canada goose damage to crops (Heinrich and Craven 1990). Flagging is impractical in many locations and has met with some local resistance due to the negative aesthetic appearance presented on the properties where it is used. Other studies have shown reflective tape ineffective (Tobin et al. 1988, Bruggers et al. 1986, Dolbeer et al. 1986, Conover and Dolbeer 1989). While sometimes effective for short periods of time, reflective tape has proven mostly ineffective in deterring resident geese.

Mute Swans: Mute swans are ineffective at preventing Canada geese from using or nesting on ponds (Conover and Kania 1994). Additionally, swans can be aggressive towards humans (Conover and Kania 1994; Chasko 1986) and may have undesirable effects on native aquatic vegetation (Allin et al. 1987, Chasko 1986). Executive Order 11987 May 24, 1977, states that federal agencies shall encourage states, local governments, and private citizens to prevent the introduction of exotic species into the environment. Until recently, mute swans were classified as an exotic species by the Federal government. A recent court case as the U.S. Court of Appeals for the District of Columbia ruled that mute swans are covered by protective/management authorities contained in the Migratory Bird Treaty Act. The use of mute swans as a Canada goose damage management technique is ineffective, and not recommended.

Dogs: Dogs can be effective at harassing waterfowl and keeping them off turf and beaches (Conover and Chasko 1985, Castelli and Sleggs 2000). Around water, this technique appears most effective when the body of water to be patrolled is less than two acres in size (Swift 1998). Although dogs can be effective in keeping waterfowl off individual properties, they do not contribute to a solution for the larger problem of overabundant waterfowl populations (Castelli and Sleggs 2000). Swift (1998) and numerous individuals in New Jersey have reported that when harassment with dogs ceases, the number of geese return to pre-treatment numbers. WS has recommended and encouraged the use of dogs where appropriate.

Repellents: Methyl Anthranilate (MA) is a registered repellent for waterfowl and is marketed under the trade names ReJeX-iT and Bird Shield. Results with MA appear to be mixed. Cummings et al. (1995) reported that MA repelled Canada geese from grazing turf for four days. However, Belant et al. (1996) found it ineffective as a grazing repellent when applied at 22.6 and 67.8 kg/ha which is the label rate and triple the label rate, respectively. MA is water soluble therefore, moderate to heavy rain or daily watering and/or mowing render MA ineffective. To use chemical repellents for waterfowl damage management in Pennsylvania, State regulations governing use of restricted chemicals must be followed. Testing in numerous locations throughout Wisconsin during the 1990s indicated that in many situations MA is cost prohibitive, is only marginally effective in repelling geese, and commonly just causes geese to move to nearby untreated areas. (P. Vagnini, West Bend Parks, Recr. and For. Dept., April, 2000, D. Keuler, Rock River Hills Golf Course, April, 2000, and G. Youngs, Milwaukee County Dept. Parks, Recr. and Culture, March, 2000, pers. comm.).

Research continues on other avian feeding repellents. A 50% anthraquinone product (FlightControl), shows promise for waterfowl (Dolbeer et al. 1998). Like MA, anthraquinone has low toxicity to birds and mammals. Activated charcoal has also been evaluated for use in deterring waterfowl damage, but it requires frequent re-application to effectively reduce waterfowl damage (Mason and Clark 1995). Further, laboratory and field trials are needed to refine minimum repellent levels and to enhance retention of treated vegetation (Sinnott 1998).

Hazing: Hazing reduces losses in those instances when the affected waterfowl move to a more acceptable area. Achieving that end has become more difficult as the local waterfowl population has increased. Birds hazed from one area where they are causing damage, frequently move to

another area where they cause damage (Brough 1969, Conover 1984, Summers 1985, Swift 1998). Smith et al. (1999) noted that others have reported similar results, stating: "..biologists are finding that some techniques (e.g., habitat modifications or scare devices) that were effective for low to moderate population levels tend to fail as flock sizes increase and waterfowl become more accustomed to human activity . Generally speaking, birds tend to habituate to hazing techniques (Zucchi and Bergman 1975, Blokpoel 1976, Summers 1985, Aubin 1990). In some locations and circumstances, hazing waterfowl is a useful component of a waterfowl damage management program.

Scarecrows: The use of scarecrows has had mixed results. Effigies depicting alligators, humans, floating swans and dead geese have been employed, with limited success for short time periods in small areas. An integrated approach (swan and predator effigies, distress calls and non-lethal chemical repellents) was found to be ineffective at scaring or repelling nuisance waterfowl (Conover and Chasko 1985). While Heinrich and Craven (1990) reported that using scarecrows reduced migrant Canada goose use of agricultural fields in rural areas, their effectiveness in scaring geese from suburban/urban areas is severely limited because geese are not afraid of humans as a result of nearly constant contact with people. In general, scarecrows are most effective when they are moved frequently, alternated with other methods, and are well maintained. However, scarecrows tend to lose effectiveness over time and become less effective as waterfowl populations increase (Smith et al. 1999).

Distress Calls: Aguilera et al. (1991) found distress calls ineffective in causing migratory and resident geese to abandon a pond. Although, Mott and Timbrook (1988) reported distress calls as effective at repelling resident geese 100 meters from the distress unit, the birds would return shortly after the calls stopped. The repellency effect was enhanced when pyrotechnics were used with the distress calls. In some situations, the level of volume required for this method to be effective in urban/suburban areas would be prohibited by local noise ordinances. A similar device, which electronically generates sound, has proven ineffective at repelling migrant waterfowl (Heinrich and Craven 1990).

Lasers: The use of lasers as non-lethal avian damage control tools, have recently been evaluated for a number of species (Blackwell et al. 2002); research on this potential tool has been conducted in a replicated format only for double-crested cormorants (Glahn et al. 2000). In experimental situations, waterfowl have exhibited avoidance reactions to lasers under low light conditions (Blackwell et al. 2002), and a field test of lasers at a Pennsylvania site demonstrated effectiveness of lasers in dispersing large flocks of waterfowl off of a lake, with nearly no habituation to the technique ([redacted] 2001). The integrated use of lasers as part of waterfowl damage management programs by WS in Pennsylvania may increase program effectiveness, and would be incorporated as appropriate. Wide scale public use of lasers is not typically recommended at this time, pending additional research (on effectiveness and impacts) on its use as a waterfowl damage management tool. In some situations (neighborhoods, schools, hospitals), use of lasers may enhance integrated control programs since they are silent and do not fire a projectile.

Pyrotechnics: Pyrotechnics (screamer shells, bird bombs, and 12-gauge cracker shells) have been used to repel many species of birds (Booth 1994). Aguilera et al. (1991) found 15mm screamer shells effective at reducing resident and migrant Canada geese use of areas of Colorado. However, Mott and Timbrook (1988) and Aguilera et al. (1991) doubted the efficacy of harassment and believed that moving the geese simply redistributed the problem to other locations.

Fairaizl (1992) and Conomy et al. (1998) found the effectiveness of pyrotechnics highly variable among different flocks of waterfowl. Some flocks in urban areas required continuous harassment throughout the day with frequent discharges of pyrotechnics. The waterfowl usually returned within hours. A minority of resident Canada goose flocks in Virginia showed no response to pyrotechnics (Fairaizl 1992). Some flocks of Canada geese in Virginia have shown quick response to pyrotechnics during winter months suggesting migrant geese made up some or all of the flock (Fairaizl 1992). Shultz et al. (1988) reported fidelity of resident Canada geese to feeding and loafing areas is strong, even when heavy hunting pressure is ongoing. Mott and Timbrook (1988) concluded that the efficacy of harassment with pyrotechnics is partially dependent on availability of alternative loafing and feeding areas. Although one of the more effective methods of frightening waterfowl away, more often than not they simply move waterfowl to other areas. There are also safety and legal implications regarding their use. Discharge of pyrotechnics is inappropriate and prohibited in some urban/suburban areas. Pyrotechnic projectiles can start fires, ricochet off buildings, pose traffic hazards, and trigger dogs to bark incessantly, annoy and possibly injure people.

In Pennsylvania, pyrotechnic launchers may be considered as firearms by some law enforcement departments. In those cases, possession and use of pyrotechnic equipment would require acquisition of appropriate permits and licenses as directed by the local Police Department. Additionally, use of pyrotechnics in certain municipalities would be constrained by local firearm discharge and noise ordinances.

Propane Cannons: Propane cannons are generally inappropriate for urban/suburban areas due to the repeated loud explosions, which many people would consider a serious and unacceptable nuisance and potential health threat (hearing damage). Although a propane cannon can be an effective dispersal tool for migrant waterfowl in agricultural settings, resident waterfowl in urban areas are more tolerant of noise and habituate to propane cannons relatively quickly.

POPULATION MANAGEMENT

Potential methods of managing the local waterfowl population include relocation, contraception, egg destruction, capture with AC, toxicants, hunting and depredation permits, capture and euthanize.

Capture and Relocation: Smith (1996) reported that groups of juvenile geese relocated from urban to rural settings can effectively eliminate these geese from urban areas, retain them at the release site, include them in the sport harvest, and expose them to higher natural mortality. Smith (1996) also reported that multiple survival models indicated that survival estimates of

relocated juveniles were half of those of urban captured and released birds. Woytek and Hestbeck (1997) reported that relocated goslings had high recovery rates, lower survival and high fidelity to relocation areas in Pennsylvania than normal wild goslings. If this method in used to reduce damage in Pennsylvania, only juvenile waterfowl would be relocated away from problem areas to new/separate properties.

Ultimately, the relocation of resident waterfowl from metropolitan communities can assist in the reduction of overabundant populations (Cooper and Keefe 1997), and has been accepted by the general public as a method of reducing waterfowl populations to socially acceptable levels (Fairaizl 1992). In addition, the removal of waterfowl posing or likely to pose a hazard to air safety at airports has been demonstrated to reduce the population of local waterfowl and decrease the number of waterfowl flights through the airport operations airspace; and resulted in increased air safety at the Minneapolis-St. Paul International Airport (Cooper 1991).

Relocation of resident waterfowl has the potential to spread disease into populations of other and/or migrating waterfowl. The AAWV (undated) "..discourages the practice of relocating nuisance or excess urban ducks, geese and swans to other parks or wildlife areas as a means of local population control."

Currently, federal and State permitting agencies in Pennsylvania do not issue permits that authorize the relocation of waterfowl from one location to another, since relocated waterfowl often cause damage at the release site and may spread disease.

Contraception: Contraceptives have not proven to be an effective method for reducing damage, and currently there are no contraceptive drugs registered with the FDA for waterfowl. Although, Canada geese have been successfully vasectomized to reduce to prevent production of young, this method is only effective if the female does not form a bond with a different male. In addition, vasectomies can only prevent the production of the mated pair. The ability to identify breeding pairs for isolation and to capture a male bird for vasectomization becomes increasingly difficult as the number of birds increase (Converse and Kennelly 1994). Waterfowl have a long life span once they survive their first year (Cramp and Simmons 1977, Allan et al. 1995); leg-band recovery data indicate that some waterfowl live longer than 20 years. The sterilization of resident waterfowl would not reduce the damage caused by the overabundance of the waterfowl population since the population would remain relatively stable. Keefe (1996) estimated sterilization of a Canada goose to cost over $100 per bird.

Egg Destruction/Reproduction Control: VerCauteren et al. (2000) examined the use of Nicarbazin (NCZ) to reduce Canada goose egg production and viability, and found that NCZ did experimentally reduce egg viability, but that there were difficulties in delivery methods and acceptance of treated feed. Additional research and field trials to document the extent to which NCZ is effective and practical as an operational population management tool are needed before this material is available to wildlife managers in field applications. Egg addling, oiling, freezing, egg replacement, or puncturing can be effective in reducing recruitment into the local population (Christens et al. 1995, Cummings et al. 1997). While egg removal/destruction can reduce

production of young, merely destroying an egg does not reduce a population as quickly as removing immature or breeding adults (Cooper and Keefe 1997). As with other species of long-lived waterfowl, which require high adult mortality to reduce populations (Rockwell et. al 1997), it is likely that adult resident waterfowl must be removed to reduce the population to a level deemed acceptable to communities. Approximately five eggs must be removed to have the effect of stopping one adult from joining the breeding population (Rockwell et al. 1997, Schmutz et al. 1997). Keefe (1996) estimated egg destruction to cost $40 for the equivalent of removing one adult goose from the population. To equal the effect of removing an adult bird from a population, all eggs produced by that bird during its entire lifetime must be removed (Smith et al. 1999). Furthermore, egg removal efforts must be nearly complete in order to prevent recruitment from a small number of surviving nests that would offset control efforts (Smith et al. 1999). Cooper and Keefe (1997), Rockwell et al. (1997), and Schmutz et al. (1997) reported that waterfowl egg destruction is only fractionally effective in attaining population reduction objectives, and that nest/egg destruction is not an efficient or cost-effective damage management or population reduction approach. The Atlantic Flyway Resident Canada Goose Management Plan (Atlantic Flyway Council 1999), states that to effectively reduce resident goose populations, an increase in adult and immature mortality rates, combined with reproductive control, is necessary. Reproductive control alone can not reduce the population in an acceptable time; treatment of 95% of all eggs each year would result in only a 25% reduction over 10 years (Allan et al. 1995). In contrast, reducing annual survival of resident Canada geese by just 10% would reduce a predicted growth rate of more than 15%/year to a stable population, assuming moderate recruitment (Atlantic Flyway Council 1999). In addition, nest destruction is estimated to cost significantly more than other forms of population management (Cooper and Keefe 1997). Egg destruction, while a valuable tool, has fallen short as a single method for reducing local waterfowl populations. Many nests cannot be found by resource managers in typical urban-suburban settings due to the difficulties in gaining access to search the hundreds of private properties where nests may occur. In addition, waterfowl which have eggs oiled in successive years may learn to nest away from the water making it more difficult to find nests. Throughout the waterfowl nesting season, WS treat or destroys waterfowl eggs to eliminate reproduction on the site, which may slow the growth of the local population and increase the impact of waterfowl harassment activities.

Capture with Alpha-Chloralose: AC may be used only by WS personnel to capture waterfowl. Pursuant to FDA restrictions, waterfowl captured with AC for subsequent euthanasia must be killed and buried or incinerated, or be held alive for at least 30 days, at which time the birds may be killed and processed for human consumption.

Toxicants: All pesticides are regulated by the EPA. There are currently no toxicants registered with the EPA for use on waterfowl and therefore none would be used by WS.

Hunting: WS sometimes recommends that resource owners consider legal hunting as an option for reducing waterfowl damage. Although legal hunting is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of resident waterfowl. Legal hunting also reinforces harassment programs (Kadlec 1968). Zielske et al. (1993) believed legal

hunting would not reduce resident Canada geese populations where there is limited interest in legally hunting resident geese. However, hunting has had a major impact on the distribution of geese in the Minneapolis-St. Paul Metro Area of Minnesota (Cooper and Keefe 1997). They reported goose densities during the summer in hunted areas of the Metro Area (which comprised only 23% of the area) were significantly lower (three times lower) than densities in unhunted areas. Similarly, Conover and Kania (1991) reported that Canada geese were more likely to cause damage in areas that waterfowl hunting was prohibited. Even in urban/suburban areas (e.g., golf courses and green spaces) there may be locations where controlled hunting would be effective in reducing waterfowl damage. In Pennsylvania, geese are legally harvested during 3 seasons: regular season, early September season, and late January season and mallard ducks are legally harvested according to the different duck zones. These seasons are described, and annual harvests are described in Section 1.3.2.3.

Shooting. Shooting waterfowl can be highly effective in removing birds from specific areas and in supplementing harassment. Currently, depredation permits are issued by the USFWS to requesters or property owners for the purpose of reducing conflicts caused by certain waterfowl and migratory birds for a $25.00 fee. When appropriate, WS recommends to the USFWS that depredation permits be issued to property owners to enable them to more effectively reduce damage associated with waterfowl. Shooting is the practice of selectively removing target birds. Shooting a few individuals from a larger flock can reinforce birds' fear of harassment techniques. Shooting is used to reduce waterfowl problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. In Pennsylvania, shooting waterfowl pursuant to a Depredation Permit from the Pennsylvania Game Commission is conducted primarily by farmers, airport personnel, municipal and county park personnel, and others.

Capture and Euthanize: The most efficient way to reduce the size of resident waterfowl population is to increase mortality among adult waterfowl. Nationwide, hunting is the major cause of waterfowl mortality, but waterfowl may seldom be available to hunters in an urban-suburban environment (Conover and Chasko 1985, Smith et al. 1999). For purposes of lethal control, resident waterfowl are usually captured with panel nets, rocket nets, drive traps, net guns, dip nets, and/or by hand. Panel nets as described by Costanzo et al. (1995) are lightweight, portable panels (approximate size 4' x 10') that are used to herd and surround waterfowl into a moveable catch pen. This method is equally efficient on hard (pavement) and soft (field) surfaces, and can be employed in such a way as to reduce stress on captured birds (place the catch pen in a shaded area) and control other impacts (place far from roadways). Rocket netting involves the setting of bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the birds to escape. Rocket netting may take place anytime during the year. Using a net gun to capture waterfowl can be conducted anytime during the year by firing a net from a shoulder mounted gun. Waterfowl that are captured and euthanized would be buried, incinerated, or processed for charitable donation.

The molt process, when resident waterfowl are flightless, typically occurs from early-June through mid-July. Migrant waterfowl are present in Pennsylvania from October through March and do not cause the majority of the conflicts in urban/suburban locations. Therefore, capture and euthanizing resident waterfowl would primarily occur from May through August 30th, although WS may conduct activities at any time, as appropriate. Resident waterfowl captured during this period may be processed for human consumption and donated to charitable organizations.

Waterfowl captured and processed for donation would only be processed by facilities licensed by the state governing authority. Typically, costs of processing and donation are paid by the requestor, and processing would usually occur at poultry processing facilities. Waterfowl determined to be unsuitable for human consumption would be disposed of pursuant to permitted authorities.

The advantages of lethal damage management by WS are that it would be applied directly to the problem population, its effects are obvious and immediate, and it carries no risk that the birds will return or move and create conflicts elsewhere. The primary disadvantage is that it is sometimes more socially controversial than other techniques. The use of lethal methods to reduce waterfowl damage can be very effective at alleviating damage and the most economical approach to reducing damage when compared to non-lethal methods (Cooper and Keefe 1997). Additionally, capture and removal of waterfowl is the most cost efficient lethal method to reduce damage, except for hunting (Cooper and Keefe 1997). Moreover, the use of lethal methods has longer effectiveness than non-lethal methods because it would likely take months to years before the original local population level of waterfowl returned. Lethal methods would also reduce conflicts among resource owners whereas non-lethal actions only move the waterfowl among resource owners (i.e., spread the damage) (Cooper and Keefe 1997, Smith et al. 1999), and possibly leave resource owners with the fewest financial means burdened with the waterfowl and the damage.

It is estimated to cost $18-25 per bird for capture and processing for human consumption (Keefe 1996, Cooper and Keefe 1997). To limit the resident goose population in the Twin Cities region of Minnesota with capture and processing, it was estimated to cost $325,000 per year (Cooper 1998). This method is at least 50% less expensive than egg/nest destruction, sterilization, or habitat modification (Keefe 1996).

APPENDIX C
Federally listed endangered and threatened species in Pennsylvania
Endangered and threatened wildlife in Pennsylvania

FEDERALLY LISTED, PROPOSED AND CANDIDATE SPECIES
(in Pennsylvania)

COMMON NAME	SCIENTIFIC NAME	STATUS*	DISTRIBUTION
FISHES			
Shortnose sturgeon**	*Acipenser brevirostrum*	E	Delaware River and other Atlantic coastal waters
REPTILES & AMPHIBIANS			
Bog turtle	*Clemmys muhlenbergii*	T	Current - Adams, Berks, Bucks, Chester, Cumberland, Delaware, Franklin, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton and York Counties. Historic - Crawford, Mercer and Philadelphia Counties
BIRDS			
Bald eagle	*Haliaeetus leucocephalus*	T	Suitable habitats across the state. Recent nesting in Butler, Crawford, Dauphin, Erie, Forest, Lancaster, Mercer, Northumberland, Pike, Tioga, Venango, Warren and York Counties. Wintering concentrations occur in association with ice-free sections of rivers, lakes and reservoirs, including the Delaware River.
Peregrine falcon (American)	*Falco peregrinus anatum*	E	Recent nesting in and around Philadelphia and Pittsburgh (Allegheny, Delaware, Philadelphia and Bucks Counties); also Dauphin, Luzerne and Lycoming Counties.
Piping plover	*Charadrius melodus*	E	Presque Isle (Erie County). Migratory. No nesting in Pennsylvania since mid-1950s.
MAMMALS			
Indiana bat	*Myotis sodalis*	E	Summer range: Blair, Elk, and McKean Counties. Winter hibernacula: Blair, Luzerne, Mifflin and Somerset Counties.
MOLLUSKS			
Clubshell mussel	*Pleurobema clava*	E	French Creek and Allegheny River watersheds; Clarion, Crawford, Erie, Forest, Mercer, Venango and Warren Counties
Northern riffleshell	*Epioblasma torulosa rangiana*	E	French Creek and Allegheny River watersheds; Clarion, Crawford, Erie, Forest, Mercer, Venango and Warren Counties
PLANTS			
Northeastern bulrush	*Scirpus ancistrochaetus*	E	Current - Adams, Bedford, Blair, Carbon, Centre, Clinton, Cumberland, Dauphin, Franklin, Huntingdon, Lackawanna, Lehigh, Lycoming, Mifflin, Monroe, Perry, Snyder and Union Counties. Historic - Northampton County
Small-whorled pogonia	*Isotria medeoloides*	T	Current - Centre and Venango Counties. Historic - Berks, Chester, Greene, Monroe, Montgomery and Philadelphia Counties

* *E = Endangered, T = Threatened, PE = Proposed Endangered, PT = Proposed Threatened, C = Candidate* *Revised 3/19/99*

** *Shortnose sturgeon is under the jurisdiction of the National Marine Fisheries Service*

FEDERALLY LISTED SPECIES THAT NO LONGER OCCUR IN PENNSYLVANIA

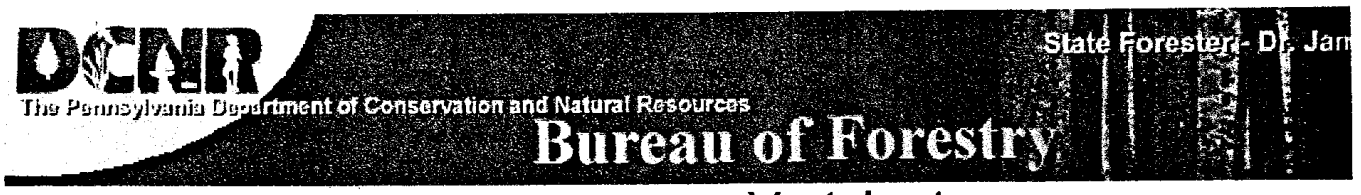
COMMON NAME	SCIENTIFIC NAME	STATUS**	FORMER DISTRIBUTION
MAMMALS			
Delmarva Peninsula fox squirrel	Sciurus niger cinereus	E	mature forests of southeastern PA (Delaware and Chester Co.)
Eastern cougar	Felis concolor couguar	E	state-wide
Grey wolf	Canis lupus	E	state-wide
MOLLUSKS			
Dwarf wedge mussel*	Alasmidonta heterodon	E	Delaware River drainage
Fanshell*	Cyprogenia stegaria	E	Ohio River drainage
Orange pimpleback*	Plethobasus striatus	E	Ohio River drainage
Pink mucket pearly mussel*	Lampsilis abrupta	E	Ohio River drainage
Ring pink mussel*	Obovaria retusa	E	Ohio River drainage
Rough pigtoe*	Pleurobema plenum	E	Ohio River drainage
INSECTS			
American burying beetle	Nicrophorus americanus	E	state-wide
Karner blue butterfly	Lycaeides melissa samuelis	E	pine barrens, oak savannas (wild lupine habitat) (Wayne Co.)
Northeastern beach tiger beetle	Cicindela dorsalis dorsalis	T	along large rivers in southeastern PA
PLANTS			
Eastern prairie fringed orchid	Platanthera leucophaea	T	wet prairies, bogs (Crawford Co.)
Sensitive joint-vetch	Aeschynomene virginica	T	freshwater tidal marshes of Delaware river (Delaware and Philadelphia Co.)
Virginia spiraea*	Spiraea virginiana	T	along Youghiogheny River (Fayette Co.)
Smooth coneflower	Echinacea laevigata	E	serpentine barrens (Lancaster Co.)

* *It is possible that remnant populations of some of these species (indicated with an *) may still occur in Pennsylvania, however, there have been no confirmed sightings of these species for over 70 years.*

** *E = Endangered, T = Threatened*

The following is a partial list of additional species that no longer occur in Pennsylvania: moose, bison, lynx, wolverine, passenger pigeon, Bachman's sparrow, greater prairie-chicken, olive-sided flycatcher, Bewick's wren, eastern tiger salamander, blue pike, butterfly mussel, Diana fritillary butterfly, precious underwing moth, deertoe mussel, marbled underwing moth, cobblestone tiger beetle, mountain clubmoss, crested yellow orchid, red milkweed, American barberry, small white lady's-slipper, etc, etc.

U.S. FISH AND WILDLIFE SERVICE
315 SOUTH ALLEN ST., SUITE 322, STATE COLLEGE, PA 16801



Vertebrates

- Home
- Recreation
- Forest Health
- Private Forest Landowners
- Forest Fire Protection
- Education & Information
- State Forest Management
- Publications
- Contacts

Last Revised 6/11/02

Scientific Name	Common Name	Global Rank	State Rank	State Status	1/2/03 Proposed State Status	Fe Sta
ACANTHARCHUS POMOTIS	MUD SUNFISH	G5	SX		PX	
ACCIPITER GENTILIS	NORTHERN GOSHAWK	G5	S2S3B,S3N		CR	
ACIPENSER BREVIROSTRUM	SHORTNOSE STURGEON	G3	S1	PE	PE	
ACIPENSER FULVESCENS	LAKE STURGEON	G3	S1	PE	PE	
ACIPENSER OXYRINCHUS	ATLANTIC STURGEON	G3	S1	PE	PE	
AEGOLIUS ACADICUS	NORTHERN SAW-WHET OWL	G5	S3B,S3N		CU	
AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW	G3	SX		PX	
ALCES ALCES	MOOSE	G5	SX		PX	
ALOSA CHRYSOCHLORIS	SKIPJACK HERRING	G5	SH?	PT	PT	
ALOSA MEDIOCRIS	HICKORY SHAD	G5	SH?	PE	PE	
AMBYSTOMA TIGRINUM	TIGER SALAMANDER	G5	SX		PX	
AMEIURUS MELAS	BLACK BULLHEAD	G5	S1?	PE	PE	
AMIA CALVA	BOWFIN	G5	S2S3	PC	CR	
AMMOCRYPTA PELLUCIDA	EASTERN SAND DARTER	G3	S1	PE	PE	
ANAS CRECCA	GREEN-WINGED TEAL	G5	S1S2B,S3N		CR	
ANEIDES AENEUS	GREEN SALAMANDER	G3G4	S1	PT	PT	
APALONE MUTICA	SMOOTH SOFTSHELL	G5	SX		PX	
APHREDODERUS SAYANUS	PIRATE PERCH	G5	SX		PX	
ARDEA HERODIAS	GREAT BLUE HERON	G5	S3S4B,S4N			
ASIO FLAMMEUS	SHORT-EARED OWL	G5	S1B,S3N	PE	PE	
ASIO OTUS	LONG-EARED OWL	G5	S2B,S2S3N		CU	
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER	G5	S1S2B	PT	PT	

BISON BISON	AMERICAN BISON	G4	SX		PX	
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN	G4	S1B	PE	PE	
CANIS LUPUS	GRAY WOLF	G4	SX		PX	(P
CARPIODES CARPIO	RIVER CARPSUCKER	G5	SR			
CARPIODES VELIFER	HIGHFIN CARPSUCKER	G4G5	SX?			
CASMERODIUS ALBUS	GREAT EGRET	G5	S1B	PE	PE	
CATHARUS USTULATUS	SWAINSON'S THRUSH	G5	S2S3B,S5N		CR	
CATOSTOMUS CATOSTOMUS	LONGNOSE SUCKER	G5	S1	PE	PE	
CERVUS ELAPHUS	WAPITI OR ELK	G5	SXSC		PX	
CHARADRIUS MELODUS	PIPING PLOVER	G3	SX		PX	
CHLIDONIAS NIGER	BLACK TERN	G4	S1B	PE	PE	
CIRCUS CYANEUS	NORTHERN HARRIER	G5	S3B,S4N		CA	
CISTOTHORUS PALUSTRIS	MARSH WREN	G5	S2S3B		CR	
CISTOTHORUS PLATENSIS	SEDGE WREN	G5	S1B	PT	PT	
CLEMMYS MUHLENBERGII	BOG TURTLE	G3	S2	PE	PE	(
CLONOPHIS KIRTLANDII	KIRTLAND'S SNAKE	G2	SH	PE	PE	
COLINUS VIRGINIANUS	NORTHERN BOBWHITE	G5	SZS3		CA	
CONTOPUS COOPERI	OLIVE-SIDED FLYCATCHER	G5	SXB		PX	
CONUROPSIS CAROLINENSIS	CAROLINA PARAKEET	GX	SX			
COREGONUS ARTEDI	CISCO	G5	SH?	PE	PE	
COREGONUS CLUPEAFORMIS	LAKE WHITEFISH	G5	SX		PX	
COREGONUS ZENITHICUS	SHORTJAW CISCO	G2	SX		PX	
COTTUS RICEI	SPOONHEAD SCULPIN	G5	SR		PX	
CROTALUS HORRIDUS	TIMBER RATTLESNAKE	G4	S3S4	PC	CA	
CRYPTOTIS PARVA	LEAST SHREW	G5	S1	PE	PE	
CULAEA INCONSTANS	BROOK STICKLEBACK	G5	S3	PC	C	
CYCLEPTUS ELONGATUS	BLUE SUCKER	G3G4	SR?	PC	CU	

CYSTOPHORA CRISTATA	HOODED SEAL	G4G5	SA			
ECTOPISTES MIGRATORIUS	PASSENGER PIGEON	GX	SX		PX	
EMPIDONAX FLAVIVENTRIS	YELLOW-BELLIED FLYCATCHER	G5	S1S2B	PT	PT	
EMYDOIDEA BLANDINGII	BLANDING'S TURTLE	G4	S1	PC	PX	
ENNEACANTHUS CHAETODON	BLACKBANDED SUNFISH	G4	SX		PX	
ENNEACANTHUS OBESUS	BANDED SUNFISH	G5	S2S3	PE	PE	
ERIMYSTAX X-PUNCTATUS	GRAVEL CHUB	G4	S1	PE	PE	
ERIMYZON SUCETTA	LAKE CHUBSUCKER	G5	SX		PX	
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	G4	S2	PT	PT	
ETHEOSTOMA EXILE	IOWA DARTER	G5	S1	PE	PE	
ETHEOSTOMA FUSIFORME	SWAMP DARTER	G5	SX		PX	
ETHEOSTOMA MACULATUM	SPOTTED DARTER	G2	S2	PT	PT	
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	G3	S2	PT	PT	
EUMECES ANTHRACINUS	COAL SKINK	G5	S3			
EUMECES LATICEPS	BROADHEAD SKINK	G5	S1	PC	CR	
FALCO PEREGRINUS	PEREGRINE FALCON	G4	S1B,S1N	PE	PE	
FELIS LYNX	LYNX	G5	SX		PX	
FELIS RUFUS	BOBCAT	G5	S3S4		CA	
FULICA AMERICANA	AMERICAN COOT	G5	S3B,S3N		CR	
GALLINAGO GALLINAGO	COMMON SNIPE	G5	S3B,S3N		CR	
GALLINULA CHLOROPUS	COMMON MOORHEN	G5	S3B			
GASTEROSTEUS ACULEATUS	THREESPINE STICKLEBACK	G5	SA?	PE	PE	
GLAUCOMYS SABRINUS	NORTHERN FLYING SQUIRREL	G5	SU			
GULO GULO	WOLVERINE	G4	SX		PX	
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	G4	S2B	PE	PE	(I
HETERODON PLATIRHINOS	EASTERN HOGNOSE SNAKE	G5	S3S4			

HIODON ALOSOIDES	GOLDEYE	G5	S2?	PT	PT
HIODON TERGISUS	MOONEYE	G5	S2?	PT	PT
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	G3G4	S2S3	PC	C
ICHTHYOMYZON FOSSOR	NORTHERN BROOK LAMPREY	G4	S1	PE	PE
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	G3G4	S2	PT	PT
ICHTHYOMYZON UNICUSPIS	SILVER LAMPREY	G5	SH		PX
ICTIOBUS BUBALUS	SMALLMOUTH BUFFALO	G5	S2	PT	PT
ICTIOBUS CYPRINELLUS	BIGMOUTH BUFFALO	G5	SX	PE	PE
IXOBRYCHUS EXILIS	LEAST BITTERN	G5	S1B	PE	PE
KINOSTERNON SUBRUBRUM	EASTERN MUD TURTLE	G5	SH		PX
LABIDESTHES SICCULUS	BROOK SILVERSIDE	G5	S3	PC	C
LAMPETRA AEPYPTERA	LEAST BROOK LAMPREY	G5	S3	CR	CR
LAMPETRA APPENDIX	AMERICAN BROOK LAMPREY	G4	S3	CR	CR
LAMPROPELTIS GETULA	COMMON KINGSNAKE	G5	SX		
LANIUS LUDOVICIANUS MIGRANS	MIGRANT LOGGERHEAD SHRIKE	G5T3Q	S1B	PE	PE
LASIONYCTERIS NOCTIVAGANS	SILVER-HAIRED BAT	G5	SUB		CR
LEPISOSTEUS OCULATUS	SPOTTED GAR	G5	S1	PE	PE
LEPISOSTEUS OSSEUS	LONGNOSE GAR	G5	S2S3	PC	CR
LEPOMIS GULOSUS	WARMOUTH	G5	S1S2	PE	PE
LEPOMIS MEGALOTIS	LONGEAR SUNFISH	G5	S1	PE	PE
LONTRA CANADENSIS	NORTHERN RIVER OTTER	G5	S3		CA
LOTA LOTA	BURBOT	G5	S1S2	PE	PE
LYTHRURUS UMBRATILIS	REDFIN SHINER	G5	S2	PE	PE
MACRHYBOPSIS STORERIANA	SILVER CHUB	G5	S1	PE	PE
MARTES AMERICANA	AMERICAN MARTEN	G5	SX		PX
MARTES PENNANTI	FISHER	G5	SC		PX

MICROTUS CHROTORRHINUS	ROCK VOLE	G4	S2		CA
MINYTREMA MELANOPS	SPOTTED SUCKER	G5	S2	PT	PT
MOXOSTOMA CARINATUM	RIVER REDHORSE	G4	S3	PC	CU
MUSTELA NIVALIS	LEAST WEASEL	G5	S3		CU
MYOTIS LEIBII	EASTERN SMALL-FOOTED MYOTIS	G3	S1B,S1N	PT	PT
MYOTIS SEPTENTRIONALIS	NORTHERN MYOTIS	G4	S3B,S3N		CR
MYOTIS SODALIS	INDIANA OR SOCIAL MYOTIS	G2	SUB,S1N	PE	PE
MYOXOCEPHALUS THOMPSONI	DEEPWATER SCULPIN	G5	SU		PX
NEOTOMA MAGISTER	ALLEGHENY WOODRAT	G3G4	S3	PT	PT
NOCOMIS BIGUTTATUS	HORNYHEAD CHUB	G5	S2	PC	CR
NOTROPIS ARIOMMUS	POPEYE SHINER	G3	S1		PX
NOTROPIS BIFRENATUS	BRIDLE SHINER	G5	S1S2	PE	PE
NOTROPIS BLENNIUS	RIVER SHINER	G5	S1?	PE	PE
NOTROPIS BUCHANANI	GHOST SHINER	G5	S1	PE	PE
NOTROPIS CHALYBAEUS	IRONCOLOR SHINER	G4	S1	PE	PE
NOTROPIS DORSALIS	BIGMOUTH SHINER	G5	S2	PT	PT
NOTROPIS HETERODON	BLACKCHIN SHINER	G5	S1	PE	PE
NOTROPIS HETEROLEPIS	BLACKNOSE SHINER	G5	SX		PX
NOTURUS ELEUTHERUS	MOUNTAIN MADTOM	G4	S1S2	PE	PE
NOTURUS GYRINUS	TADPOLE MADTOM	G5	S1	PE	PE
NOTURUS MIURUS	BRINDLED MADTOM	G5	S2	PT	PT
NOTURUS STIGMOSUS	NORTHERN MADTOM	G3	S2	PE	PE
NYCTANASSA VIOLACEA	YELLOW-CROWNED NIGHT-HERON	G5	S1B	PE	PE
NYCTICEIUS HUMERALIS	EVENING BAT	G5	SUB,SUN		CR
NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON	G5	S2S3B		CA

OPHEODRYS AESTIVUS	ROUGH GREEN SNAKE	G5	S1	PT	PT
OPSOPOEODUS EMILIAE	PUGNOSE MINNOW	G5	S1SE?		
ORYZOMYS PALUSTRIS	MARSH RICE RAT	G5	SX		PX
PANDION HALIAETUS	OSPREY	G5	S2B	PT	PT
PARARHINICHTHYS BOWERSI	CHEAT MINNOW	G1G2Q	S1?		CU
PERCINA COPELANDI	CHANNEL DARTER	G4	S1S2	PT	PT
PERCINA EVIDES	GILT DARTER	G4	S1S2	PT	PT
PERCINA MACROCEPHALA	LONGHEAD DARTER	G3	S2	PT	PT
PERCINA OXYRHYNCHUS	SHARPNOSE DARTER	G4	SX		PX
PHOCA VITULINA	HARBOR SEAL	G5	SA		
PHOCOENA PHOCOENA	HARBOR PORPOISE	G4G5	SA		
PHOXINUS EOS	NORTHERN REDBELLY DACE	G5	SX		PX
PHOXINUS ERYTHROGASTER	SOUTHERN REDBELLY DACE	G5	S2S3	PT	PT
PIMEPHALES VIGILAX	BULLHEAD MINNOW	G5	SU		CU
PIRANGA RUBRA	SUMMER TANAGER	G5	S3B		CR
PLEGADIS FALCINELLUS	GLOSSY IBIS	G5	SAB		
PODILYMBUS PODICEPS	PIED-BILLED GREBE	G5	S3B,S4N		CR
POLYODON SPATHULA	PADDLEFISH	G4	SXSC		PX
PORZANA CAROLINA	SORA	G5	S3B		
PROTONOTARIA CITREA	PROTHONOTARY WARBLER	G5	S2S3B		CR
PSEUDACRIS TRISERIATA KALMI	NEW JERSEY CHORUS FROG	G5T4	S1	PE	PE
PSEUDEMYS RUBRIVENTRIS	REDBELLY TURTLE	G5	S2	PT	CA
PSEUDOTRITON MONTANUS	MUD SALAMANDER	G5	S1	PE	CR
PUMA CONCOLOR COUGUAR	EASTERN COUGAR	G5TH	SX		PX
RALLUS ELEGANS	KING RAIL	G4G5	S1B	PE	PE
RALLUS LIMICOLA	VIRGINIA RAIL	G5	S3B		
RANA SPHENOCEPHALA	COASTAL PLAIN LEOPARD FROG	G5	S2	PE	PE

SALVELINUS NAMAYCUSH	LAKE TROUT	G5	S?		
SCAPHIOPUS HOLBROOKII	EASTERN SPADEFOOT	G5	S1S2		
SCAPHIRHYNCHUS PLATORYNCHUS	SHOVELNOSE STURGEON	G4	SX		
SCIURUS NIGER CINEREUS	DELMARVA FOX SQUIRREL	G5T3	SX	PE	PX
SCIURUS NIGER VULPINUS	EASTERN FOX SQUIRREL	G5T4T5	SU		CR
SISTRURUS CATENATUS CATENATUS	EASTERN MASSASAUGA	G3G4T3T4	S1S2	PE	PE
SOREX DISPAR	LONG-TAILED OR ROCK SHREW	G4	S3		
SOREX PALUSTRIS ALBIBARBIS	WATER SHREW	G5T5	S3		CR
SOREX PALUSTRIS PUNCTULATUS	SOUTHERN WATER SHREW	G5T3	S1	PT	PT
SPILOGALE PUTORIUS	EASTERN SPOTTED SKUNK	G5	SH		PE
SPIZA AMERICANA	DICKCISSEL	G5	S2B		PT
STERNA HIRUNDO	COMMON TERN	G5	SXB	PE	PE
STIZOSTEDION VITREUM GLAUCUM	BLUE PIKE	G5TX	SX		PX
SYLVILAGUS OBSCURUS	APPALACHIAN COTTONTAIL	G4	SU		
TAXIDEA TAXUS	AMERICAN BADGER	G5	SA	N	
THRYOMANES BEWICKII ALTUS	APPALACHIAN BEWICK'S WREN	G5T2Q	SH		PX
TYMPANUCHUS CUPIDO	GREATER PRAIRIE-CHICKEN	G4	SX		PX
TYTO ALBA	BARN-OWL	G5	S3B,S3N		CA
UMBRA LIMI	CENTRAL MUDMINNOW	G5	S3	PC	C
UMBRA PYGMAEA	EASTERN MUDMINNOW	G5	S3	PC	C

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Scientific Name	Common Name	Global Rank	State Rank	State Status	Propose State Status
ACRONICTA ALBARUFA	BARRENS DAGGER MOTH	G3G4	SX		
ACRONICTA LANCEOLARIA	A NOCTUID MOTH	G4	SU		
AESHNA CLEPSYDRA	SPOTTED BLUE DARNER	G4	S2S3		
AESHNA MUTATA	SPRING BLUE DARNER	G3G4	S1		
ALASMIDONTA HETERODON	DWARF WEDGEMUSSEL	G1G2	S1		PX
ALASMIDONTA VARICOSA	BROOK FLOATER	G3	S2		PE
AMBLEMA PLICATA	THREE-RIDGE	G5	S2S3		PT
AMBLYSCIRTES VIALIS	ROADSIDE SKIPPER	G5	S?		
AMELETUS BROWNI		G3	S?		
ANAX LONGIPES	LONG-LEGGED GREEN DARNER	G5	S1S2		
ANISOTA STIGMA	SPINY OAKWORM MOTH	G5	S?		
ANODONTA IMPLICATA	ALEWIFE FLOATER	G5	SH		CU
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL	G5	S2S3		PE
ANOMOGYNA ELIMATA	SOUTHERN VARIABLE DART MOTH	G5	SU		
APAMEA BURGESSI	A CUTWORM MOTH	G4	SH		
APAMEA CRISTATA	A NOCTUID MOTH	G4	SU		
APHARETRA PURPUREA	A NOCTUID MOTH	G4	S2		
APLECTOIDES CONDITA	A NOCTUID MOTH	G4	S2S3		
APODREPANULATRIX LIBERARIA	A GEOMETER MOTH	G4	S3		
ARCTOSA LITTORALIS	A SAND SPIDER	G?	S?	N	

ARGIA BIPUNCTULATA	TWO-SPOTTED DANCER	G4	SU
ARGIA FUMIPENNIS	VARIABLE DANCER	G5	S?
ARGIA TIBIALIS	EASTERN DANCER	G5	SH
ARIGOMPHUS FURCIFER	FORKED CLUBTAIL DRAGONFLY	G5	S2
ARTACE CRIBRARIA	DOT-LINED WHITE MOTH	G5	S1
ATRYTONE AROGOS AROGOS	AROGOS SKIPPER	G3G4T1T2	SX
ATRYTONOPSIS HIANNA	DUSTED SKIPPER	G4G5	S3
AUTOCHTON CELLUS	GOLDEN-BANDED SKIPPER	G4	SH
BAGISARA GULNARE	A NOCTUID MOTH	G4	SU
BAGISARA RECTIFASCIA	STRAIGHT LINED MALLOW MOTH	G4	SU
BOYERIA GRAFIANA	OCELLATED DARNER	G5	S3
BRACHIONYCHA BOREALIS	BOREAL FAN MOTH	G4	SH
CAECIDOTEA FRANZI	FRANZ'S CAVE ISOPOD	G2G3	S1
CAECIDOTEA KENKI	AN ISOPOD	G3	S1
CAECIDOTEA PRICEI	PRICE'S CAVE ISOPOD	G3G4	S2S3
CALEPHELIS BOREALIS	NORTHERN METALMARK	G3G4	S2
CALOPTERYX AEQUABILIS	BLACK-BANDED BANDWING	G5	S2
CALOPTERYX AMATA	SUPERB JEWELWING	G4	S2S3
CALOPTERYX ANGUSTIPENNIS	APPALACHIAN JEWELWING	G4	SU
CALYCOPIS CECROPS	RED-BANDED HAIRSTREAK	G5	S2S3
CARIPETA ARETARIA	SOUTHERN PINE LOOPER MOTH	G4	S1
CARTEROCEPHALUS PALAEMON MANDAN	ARCTIC SKIPPER	G5T5	S2
CATOCALA MARMORATA	MARBLED UNDERWING MOTH	G3G4	SX
CATOCALA MIRANDA	A NOCTUID MOTH	G4	SU
CATOCALA PRETIOSA PRETIOSA	PRECIOUS UNDERWING MOTH	G4T2T3	SX
CATOCALA SP 1	PINE WOODS UNDERWING	G5	S1
CELASTRINA EBENINA	SOOTY AZURE	G4	SH

CELASTRINA NEGLECTAMAJOR	APPALACHIAN BLUE	G4	S3S4
CERMA CORA	A BIRD-DROPPING MOTH	G3G4	S?
CHAETAGLAEA CERATA	A SALLOW MOTH	G3G4	S1
CHAETAGLAEA TREMULA	BARRENS CHAETAGLAEA	G5	S1
CHEUMATOPSYCHE HELMA	HELMA'S CHEUMATOPSYCHE CADDISFLY	G1G3	S1
CHEUMATOPSYCHE VANNOTEI	VANNOTE'S CHEUMATOPSYCHE CADDISFLY	GH	SH
CHLOSYNE GORGONE	GORGONE CHECKERSPOT	G5	SH
CHLOSYNE HARRISII	HARRIS' CHECKERSPOT	G4	S3
CHYTONIX SENSILIS	MARVEL MOTH	G4	S1
CICINDELA ANCOCISCONENSIS	A TIGER BEETLE	G3	S1
CICINDELA FORMOSA	A TIGER BEETLE	G5	S1
CICINDELA HIRTICOLLIS	BEACH-DUNE TIGER BEETLE	G5	S2S3
CICINDELA LEPIDA	LITTLE WHITE TIGER BEETLE	G4	SH
CICINDELA LIMBALIS	A TIGER BEETLE	G5	S3
CICINDELA MARGINIPENNIS	COBBLESTONE TIGER BEETLE	G2G3	SX
CICINDELA PATRUELA	A TIGER BEETLE	G3	S2S3
CICINDELA SCUTELLARIS	A TIGER BEETLE	G5	SH
CICINDELA SPLENDIDA	A TIGER BEETLE	G5	SH
CICINDELA UNIPUNCTATA	A TIGER BEETLE	G4	SH
CICINNUS MELSHEIMERI	MELSHEIMER'S SACK BEARER	G4	S1
CISTHENE PACKARDII	PACKARD'S LICHEN MOTH	G5	S1S3
CISTHENE PLUMBEA	LEAD COLORED LICHEN MOTH	G5	S1
CITHERONIA REGALIS	REGAL MOTH	G5	SU
CITHERONIA SEPULCRALIS	PINE DEVIL	G5	SH
CLOEON COGNATUM		G3	S?

COENAGRION RESOLUTUM	RESOLUTE DAMSEL	G5	S1		
COLEOPHORA LEUCOCHRYSELLA	CHESTNUT CASE-BEARER MOTH	G?	SX		
COLIAS INTERIOR	PINK-EDGED SULPHUR	G5	SH		
CRAMBIDIA CEPHALICA	LICHEN MOTH	G4	S1S2		
CRAMBIDIA PURA	PURE LICHEN MOTH	G4	SU		
CRANGONYX DEAROLFI	PENNSYLVANIA CAVE AMPHIPOD	G2G3	S1		
CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK	G5	SX		PX
CYCLOPHORA NANARIA	A GEOMETRID MOTH	G5	S1S2		
CYPROGENIA STEGARIA	FANSHELL	G1	SX		PX
DACTYLOCYTHERE SUTERI	AN OSTRACOD	GU	SU		
DATANA RANAECEPS	A HAND-MAID MOTH	G3G4	S1		
DERRIMA STELLATA	PINK STAR MOTH	G4	SH		
DIARSIA RUBIFERA		G5	SU		
DOROCORDULIA LEPIDA	ELEGANT SKIMMER	G5	S2		
DRYOBIUS SEXNOTATUS	SIX-BANDED LONGHORN BEETLE	G?	SH		
ELAPHRIA FESTIVOIDES	A NOCTUID MOTH	G5	S5		
ELAPHRIA GEORGEI	A MIDGET MOTH	G4	S?		
ELAPHRIA SP 1 NR FESTIVOIDES		G5	SU		
ELLIPSARIA LINEOLATA	BUTTERFLY MUSSEL	G4	SX		PX
ELLIPTIO CRASSIDENS	ELEPHANT EAR	G5	SX		PX
ELLIPTIO FISHERIANA	NORTHERN LANCE	G4	SH		CU
ELLIPTIO PRODUCTA	ATLANTIC SPIKE	G4Q	S2		N
ENALLAGMA BOREALE	BOREAL BLUET	G5	S2		
ENALLAGMA LATERALE	LATERAL BLUET	G3	S1		
EPIGLAEA APIATA	POINTED SALLOW	G5	S3S4		
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	G2T2	S2	PE	PE
EPIOBLASMA TRIQUETRA	SNUFFBOX	G3	S1		PE
EPIRRITA AUTUMNATA	NOVEMBER MOTH	G5T5	SU		

HENSHAWI				
ERASTRIA COLORARIA	BROAD-LINED ERASTRIA MOTH	G4	S1	
ERYNNIS LUCILIUS	COLUMBINE DUSKYWING	G4	S1S2	
ERYNNIS MARTIALIS	MOTTLED DUSKYWING	G3G4	S1S2	
ERYNNIS PERSIUS PERSIUS	PERSIUS DUSKYWING	G5T2T3	S1S2	
EUCHLOE OLYMPIA	OLYMPIA MARBLE	G4G5	S1	
EUPHYES CONSPICUUS	BLACK DASH	G4	S3	
EUPHYES DION	SEDGE SKIPPER	G4	S1	
EURYLOPHELLA BICOLOROIDES		G3	S?	
EURYLOPHELLA POCONOENSIS		G1	S?	
EUXOA VIOLARIS	VIOLET DART MOTH	G4	SH	
FAGITANA LITTERA	A NOCTUID MOTH	G4	SH	
FIXSENIA FAVONIUS ONTARIO	NORTHERN HAIRSTREAK	G4T4	S1S3	
FUSCONAIA FLAVA	WABASH PIGTOE	G5	S2	PE
FUSCONAIA SUBROTUNDA	LONG-SOLID	G3	S1	PE
GLAUCOPSYCHE LYGDAMUS	SILVERY BLUE	G5T4	S2	
GLENA COGNATARIA	LYGDAMUS BLUEBERRY GRAY	G4	S1	
GOMPHAESCHNA ANTILOPE	SOUTHERN BOG DARNER	G4	SH	
GOMPHUS ABBREVIATUS	ABBREVIATED CLUBTAIL DRAGONFLY	G3G4	S2	
GOMPHUS ADELPHUS	MOUSTACHED CLUBTAIL	G4	S?	
GOMPHUS DESCRIPTUS	HARPOON CLUBTAIL	G4	S1S2	
GOMPHUS FRATERNUS	BROTHERLY CLUBTAIL	G5	S2S3	
GOMPHUS LINEATIFRONS	LINED CLUBTAIL	G4	SX	
GOMPHUS QUADRICOLOR	RAPIDS CLUBTAIL	G3G4	S1S2	
GOMPHUS ROGERSI	ROGER'S CLUBTAIL	G4	S1	
GOMPHUS VENTRICOSUS	WIDE-TAILED CLUBTAIL	G3	SX	
GOMPHUS VIRIDIFRONS	GREEN-FACED CLUBTAIL	G3	S1	
GRAMMIA PHYLLIRA	PHYLLIRA TIGER MOTH	G4	SH	

HELOCORDULIA UHLERI	UHLER'S SUNFLY	G5	S3		
HEMARIS GRACILIS	GRACEFUL CLEARWING	G3G4	SH		
HEMILEUCA MAIA	BARRENS BUCKMOTH	G5	S1S2		
HEMILEUCA SP 3	MIDWESTERN FEN BUCKMOTH	G3G4Q	S1		
HEMIPACHNOBIA MONOCHROMATEA	SUNDEW CUTWORM MOTH	G4	S2S3		
HEMISTENA LATA	CRACKING PEARLYMUSSEL	G1	SX		PX
HEPTAGENIA CULACANTHA		G3	S?		
HESPERIA ATTALUS SLOSSONAE	DOTTED SKIPPER	G3G4T3	SX		
HESPERIA LEONARDUS	LEONARD'S SKIPPER	G4	S3S4		
HESPERIA METEA	COBWEB SKIPPER	G4G5	S2S3		
HETAERINA TITIA	TITIAN RUBY-SPOT	G5	S2		
HOLOMELINA LAETA	JOYFUL HOLOMELINA MOTH	G5	SU		
HOLOMELINA NIGRICANS		GHQ	S?		
HYDRAECIA IMMANIS	A NOCTUID MOTH	G4	SU		
HYDRAECIA STRAMENTOSA	A MOTH	G4	SU		
HYPAGYRTIS ESTHER	ESTHER MOTH	G5	S2S3		
IDAEA EREMIATA		G4	S1		
IDAEA VIOLACEARIA	A WAVE MOTH	G4	S1		
INCISALIA HENRICI	HENRY'S ELFIN	G5	S2S3		
INCISALIA IRUS	FROSTED ELFIN	G3	S2		
INCISALIA POLIA	HOARY ELFIN	G5	S1		
ISONYCHIA HOFFMANI		G1	S?		
ITAME SP 1	BARRENS ITAME (cf I. INEXTRICATA)	G3	S1		
LAGOA CRISPATA	BLACK-WAVED FLANNEL MOTH	G5	S1		
LAMPSILIS ABRUPTA	PINK MUCKET	G2	SX		PX
LAMPSILIS CARIOSA	YELLOW LAMPMUSSEL	G3G4	S3S4		CU
LAMPSILIS RADIATA	EASTERN LAMPMUSSEL	G5	S2		CU
LANTHUS PARVULUS	ZORRO CLUBTAIL	G4	S3S4		
LASIUS MINUTIS	AN ANT	G?	S?	N	
LASMIGONA COMPLANATA	WHITE HEELSPLITTER	G5	S1		PE

LASMIGONA COMPRESSA	CREEK HEELSPLITTER	G5	S2S3	PE
LASMIGONA SUBVIRIDIS	GREEN FLOATER	G3	S2	CU
LEMMERIA DIGITALIS	A NOCTUID MOTH	G4G5	SH	
LEPTODEA FRAGILIS	FRAGILE PAPERSHELL	G5	S2	PT
LEPTODEA OCHRACEA	TIDEWATER MUCKET	G4	SX	PX
LEUCORRHINIA PROXIMA	CANADIAN WHITE-FACED SKIMMER	G5	S2	
LIGUMIA NASUTA	EASTERN PONDMUSSEL	G4G5	S1	
LITHOMOIA SOLIDAGINIS GERMANA	A MOTH	G5T5	S3S4	
LITHOPHANE FRANCLEMONTI		GU	SH	
LITHOPHANE THAXTERI	THAXTER'S PINION MOTH	G4	SH	
LORDITHON NIGER	BLACK LORDITHON ROVE BEETLE	G1	SX	
LYCAEIDES MELISSA	MELISSA BLUE	G5	SX	
LYCAEIDES MELISSA SAMUELIS	KARNER BLUE BUTTERFLY	G5T2	SX	
LYCAENA EPIXANTHE	BOG COPPER	G4G5	S2	
LYCAENA HYLLUS	BRONZE COPPER	G5	S2	
LYCIA RACHELAE	TWILIGHT MOTH	G4	S1	
MACROMIA ALLEGHANIENSIS	ALLEGHENY RIVER SKIMMER	G4	SH	
MARGARITIFERA MARGARITIFERA	EASTERN PEARLSHELL	G4	S1	PE
MEGACEPHALA VIRGINICA	VIRGINIA BIG-HEADED TIGER BEETLE	G5	SH	
MEROLONCHE DOLLI	DOLL'S MEROLONCHE	G3G4	S1	
MEROPE TUBER	EARWIG SCORPIONFLY	G3G5	SU	
METARRANTHIS APICIARIA	BARRENS METARRANTHIS MOTH	GU	SH	
METAXAGLAEA SEMITARIA	FOOTPATH SALLOW MOTH	G5	S2	
MITOURA GRYNEA	OLIVE HAIRSTREAK	G5	S3	
NANNOTHEMIS BELLA	DWARF SKIMMER	G4	SH	

NASIAESCHNA PENTACANTHA	BLUE-NOSED DARNER	G5	S2		
NICROPHORUS AMERICANUS	AMERICAN BURYING BEETLE	G2G3	SH		
NICROPHORUS MARGINATUS	A BURYING BEETLE	G?	SX		
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	G5	SX		PX
OBOVARIA OLIVARIA	HICKORYNUT	G4	SX		PX
OBOVARIA RETUSA	RING PINK	G1	SX		PX
OBOVARIA SUBROTUNDA	ROUND HICKORYNUT	G4	S1		PE
OLIGIA HAUSTA	NORTHERN BROCADE MOTH	G4	S1		
OPHIOGOMPHUS ANOMALUS	IRREGULAR SNAKETAIL	G3	S1		
OPHIOGOMPHUS EDMUNDO	EDMUND'S SNAKETAIL	G1G2	SX		
OPHIOGOMPHUS HOWEI	MIDGET SNAKETAIL DRAGONFLY	G3	S1		
OPHIOGOMPHUS MAINENSIS	TWIN-HORNED SNAKETAIL	G4	S3		
ORCONECTES PROPINQUUS	NORTHERN CLEARWATER CRAYFISH	G5	S3S4		
OXYSOMA CUBANA	A SAC-SPIDER	G?	S?	N	
PALAEMONETES KADIAKENSIS	MISSISSIPPI GRASS SHRIMP	G4	SU		
PANOQUINA PANOQUIN	SALT-MARSH SKIPPER	G5	SH		
PAPAIPEMA AERATA	A BORER MOTH	GH	SH		
PAPAIPEMA LEUCOSTIGMA	COLUMBINE BORER	G4	SU		
PAPAIPEMA MARGINIDENS	A BORER MOTH	G4	SU		
PAPAIPEMA SP 1	FLYPOISON BORER MOTH	G2G3	S2		
PAPAIPEMA SP 2		G3G4	S?		
PAPILIO CRESPHONTES	GIANT SWALLOWTAIL	G5	S2		
PARAHYPENODES QUADRALIS		G4	SU		
PARALEPTOPHLEBIA ASSIMILIS		G2	S?		
PHOBERIA ORTHOSIOIDES	AN OAK MOTH	G4	S3		
PHYCIODES BATESII	TAWNY CRESCENT	G4	SH		
PHYCIODES SELENIS	PASCO CRESCENT	G5	S3S4		
PLATYPERIGEA MERALIS	A NOCTUID MOTH	G4	S1		

PLETHOBASUS COOPERIANUS	ORANGE-FOOT PIMPLEBACK	G1	SX		PX
PLETHOBASUS CYPHYUS	SHEEPNOSE MUSSEL	G3	S1		PE
PLEUROBEMA CLAVA	CLUBSHELL	G2	S1S2	PE	PE
PLEUROBEMA CORDATUM	OHIO PIGTOE	G3	SX		PX
PLEUROBEMA PLENUM	ROUGH PIGTOE	G1	SX		PX
PLEUROBEMA PYRAMIDATUM	PYRAMID PIGTOE	G2	SX		PX
PLEUROBEMA SINTOXIA	ROUND PIGTOE	G4	S2		PE
POANES MASSASOIT	MULBERRY WING	G4	S2		
POANES VIATOR VIATOR	BROAD-WINGED SKIPPER	G5T4	SU		
POANES VIATOR ZIZANIAE	BROAD-WINGED SKIPPER	G5T5	S1		
POLYGONIA FAUNUS	FAUNUS ANGLEWING	G5	S3S4B,SZN		
POLYGONIA PROGNE	GRAY COMMA	G5	SU		
PONTIA PROTODICE	CHECKERED WHITE	G4	SH		
POTAMILUS ALATUS	PINK HEELSPLITTER	G5	S2		PT
PROCAMBARUS ACUTUS	WHITE RIVER CRAWFISH	G5	SU		
PROGOMPHUS OBSCURUS	OBSCURE CLUBTAIL	G5	S2		
PROPERIGEA SP 1	A NOCTUID MOTH	G2G3Q	S1		
PSECTRAGLAEA CARNOSA	PINK SALLOW	G3	S1		
PYREFERRA CEROMATICA	ANOINTED SALLOW MOTH	GU	SX		
PYRGUS WYANDOT	SOUTHERN GRIZZLED SKIPPER	G2	S1		
QUADRULA CYLINDRICA	RABBITSFOOT	G3	S1		PE
QUADRULA METANEVRA	MONKEYFACE	G4	SX		PX
QUADRULA PUSTULOSA	PIMPLEBACK	G5	SX		PX
QUADRULA QUADRULA	MAPLELEAF	G5	S1S2		PT
RENIA SP 1 NR DISCOLORALIS		G4	S1?		
RHODOECIA AURANTIAGO	AUREOLARIA SEED BORER	G4	SH		
RICHIA GROTEI	A NOCTUID MOTH	G4	S1		
SEMIOTHISA PROMISCUATA	PROMISCUOUS ANGLE	G4	S1		

SIDERIDIS MARYX		G4	S1S3		
SIMPSONAIAS AMBIGUA	SALAMANDER MUSSEL	G3	S1?		CU
SINGA EUGENIE	AN ORB-WEAVER SPIDER	G?	S?	N	
SOMATOCHLORA ELONGATA	SKI-TAILED EMERALD	G5	S2		
SOMATOCHLORA FORCIPATA	FORCIPATE BOG SKIMMER	G5	S2		
SOMATOCHLORA INCURVATA	MICHIGAN BOG SKIMMER	G4	S1		
SOMATOCHLORA LINEARIS	LINED BOG SKIMMER	G5	S1		
SOMATOCHLORA WALSHII	WALSH'S EMERALD	G5	S2		
SOMATOCHLORA WILLIAMSONI	WILLIAMSON'S BOG SKIMMER	G5	S1		
SPEYERIA DIANA	DIANA	G3	SAH		
SPEYERIA IDALIA	REGAL FRITILLARY	G3	S1		
SPHALLOPLANA PRICEI	REFTON CAVE PLANARIAN	G1G3	S1		
SPHINX FRANCKII	FRANCK'S SPHINX MOTH	G4	SH		
SPHINX GORDIUS		G4	S1S3		
SPONGILLA LACUSTRIS	A FRESHWATER SPONGE	G?	S1?		
STAMNODES GIBBICOSTATA	SHINY GRAY CARPET MOTH	G4	SU		
STAPHYLUS HAYHURSTII	SCALLOPED SOOTYWING	G5	S1		
STENACRON GILDERSLEEVEI		G3	S?		
STYGOBROMUS ALLEGHENIENSIS	ALLEGHENY CAVE AMPHIPOD	G4	S2S3		
STYGOBROMUS BIGGERSI	BIGGERS' CAVE AMPHIPOD	G2G4	S1		
STYGOBROMUS FRANZI	FRANZ'S CAVE AMPHIPOD	G2G3	S?		
STYGOBROMUS GRACILIPES	SHENANDOAH VALLEY CAVE AMPHIPOD	G2G4	S1		
STYGOBROMUS PIZZINII	PIZZINI'S CAVE AMPHIPOD	G2G4	S1		
STYGOBROMUS STELLMACKI	STELLMACK'S CAVE AMPHIPOD	G1G2	S1		
STYGOBROMUS TENUIS POTOMACUS	POTOMAC GROUNDWATER AMPHIPOD	G4T3T4Q	S1		
STYLURUS AMNICOLA	RIVER CLUBTAIL DRAGONFLY	G4	SX		

STYLURUS NOTATUS	MARKED CLUBTAIL	G3	SX	
STYLURUS PLAGIATUS	OBLIQUE CLUBTAIL	G5	SX	
STYLURUS SCUDDERI	ZEBRA CLUBTAIL	G4	S1	
SUTYNA PRIVATA TELTOWA		G5T4	S1	
SWAMMERDAMIA CASTANEAE	YPONOMEUTID MOTH	GHQ	SX	
SYMPETRUM COSTIFERUM	SAFFRON-BORDERED MEADOWFLY	G5	S1?	
SYNANTHEDON CASTANEAE	AMERICAN CHESTNUT CLEARWING MOTH	G3G5	SH	
TACHOPTERYX THOREYI	THOREY'S GRAYBACK DRAGONFLY	G4	S3	
THORYBES CONFUSIS	EASTERN CLOUDYWING	G4	SH	
TOLYPE NOTIALIS	TOLYPE MOTH	G?	S1	
TOXOLASMA PARVUM	LILLIPUT	G5	S1S2	PE
TRITOGONIA VERRUCOSA	PISTOLGRIP MUSSEL	G4	S1	PE
TRUNCILLA DONACIFORMIS	FAWNSFOOT	G5	S1	CU
TRUNCILLA TRUNCATA	DEERTOE	G5	SX	PX
VILLOSA FABALIS	RAYED BEAN MUSSEL	G1G2	S1S2	PE
VILLOSA IRIS	RAINBOW MUSSEL	G5	S1	PE
XYLOTYPE CAPAX	BROAD SALLOW MOTH	G4	S3	
ZALE CUREMA	A ZALE MOTH	G3G4	S1	
ZALE METATA	A ZALE MOTH	G5	S?	
ZALE OBLIQUA	OBLIQUE ZALE MOTH	G5	S1	
ZALE SP 1	PINE BARRENS ZALE	G3Q	S1	
ZALE SQUAMULARIS		G4	S2S3	
ZALE SUBMEDIANA	A ZALE MOTH	G4	S2	
ZANCLOGNATHA MARTHA	PINE BARRENS ZANCLOGNATHA	G4	S1S2	

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Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Fe St
ACALYPHA DEAMII	THREE-SEEDED MERCURY	G4?	SX	N	PX	
ACONITUM RECLINATUM	WHITE MONKSHOOD	G3	S1	PE	PE	
ACONITUM UNCINATUM	BLUE MONKSHOOD	G4	S2	PT	PT	
ACORUS AMERICANUS	SWEET FLAG	G5	S1	PE	PE	
ADIANTUM ALEUTICUM	ALEUTIAN MAIDENHAIR FERN	G5?	SR	TU	TU	
AESCHYNOMENE VIRGINICA	SENSITIVE JOINT-VETCH	G2	SX	PX	PX	
AGALINIS AURICULATA	EARED FALSE-FOXGLOVE	G3	S1	PE	PE	
AGALINIS DECEMLOBA	BLUE-RIDGE FALSE-FOXGLOVE	G4Q	SX	PX	PX	
AGALINIS PAUPERCULA	SMALL-FLOWERED FALSE-FOXGLOVE	G5	S1	PE	PE	
AGROSTIS ALTISSIMA	TALL BENTGRASS	G4	SX	PX	PX	
ALETRIS FARINOSA	COLIC-ROOT	G5	S1	TU	PE	
ALISMA TRIVIALE	BROAD-LEAVED WATER-PLANTAIN	G5	S1	PE	PE	
ALNUS VIRIDIS	MOUNTAIN ALDER	G5	S1	PE	PE	
ALOPECURUS AEQUALIS	SHORT-AWN FOXTAIL	G5	S3	N	TU	(
AMARANTHUS CANNABINUS	WATERHEMP RAGWEED	G5	S3	PR	PR	
AMELANCHIER BARTRAMIANA	OBLONG-FRUITED SERVICEBERRY	G5	S1	PE	PE	
AMELANCHIER CANADENSIS	SERVICEBERRY	G5	S?	N	UEF	
AMELANCHIER HUMILIS	SERVICEBERRY	G5	S1	TU	PE	
AMELANCHIER OBOVALIS	COASTAL JUNEBERRY	G4G5	S1	TU	PE	
AMELANCHIER SANGUINEA	ROUNDLEAF SERVICEBERRY	G5	S1	TU	PE	

AMMANNIA COCCINEA	SCARLET AMMANNIA	G5	S2	PE	PT
AMMOPHILA BREVILIGULATA	AMERICAN BEACHGRASS	G5	S2	PT	PT
ANDROMEDA POLIFOLIA	BOG-ROSEMARY	G5	S3	PR	PR
ANDROPOGON GLOMERATUS	BUSHY BLUESTEM	G5	S3	TU	PR
ANDROPOGON GYRANS	ELLIOTT'S BEARDGRASS	G5	S3	N	PR
ANEMONE CYLINDRICA	LONG-FRUITED ANEMONE	G5	S1	PE	PE
ANTENNARIA SOLITARIA	SINGLE-HEADED PUSSY-TOES	G5	S1	TU	PE
ANTENNARIA VIRGINICA	SHALE BARREN PUSSYTOES	G4	S3	N	PR
APLECTRUM HYEMALE	PUTTYROOT	G5	S3	PR	PR
ARABIS HIRSUTA	WESTERN HAIRY ROCK-CRESS	G5	S1	TU	PE
ARABIS MISSOURIENSIS	MISSOURI ROCK-CRESS	G4G5Q	S1	PE	PE
ARABIS PATENS	SPREADING ROCKCRESS	G3	S2	N	PT
ARCEUTHOBIUM PUSILLUM	DWARF MISTLETOE	G5	S2	PT	PT
ARCTOSTAPHYLOS UVA-URSI	BEARBERRY MANZANITA	G5	SX	PX	PX
ARETHUSA BULBOSA	SWAMP-PINK	G4	S1	PE	PE
ARISTIDA DICHOTOMA VAR CURTISSII	THREE-AWNED GRASS	G5T5	SH	TU	TU
ARISTIDA PURPURASCENS	ARROW-FEATHERED THREE AWNED	G5	S2	PT	PT
ARNICA ACAULIS	LEOPARD'S-BANE	G5	S1	PE	PE
ARTEMISIA CAMPESTRIS SSP CAUDATA	BEACH WORMWOOD	G5T5	S1	PE	PE
ASCLEPIAS RUBRA	RED MILKWEED	G4G5	SX	PX	PX
ASCLEPIAS VARIEGATA	WHITE MILKWEED	G5	S1	TU	PE
ASPLENIUM BRADLEYI	BRADLEY'S SPLEENWORT	G4	S1	PT	PE
ASPLENIUM PINNATIFIDUM	LOBED SPLEENWORT	G4	S3	N	PR
ASPLENIUM RESILIENS	BLACK-STEMMED SPLEENWORT	G5	S1	PE	PE
ASTER BOREALIS	RUSH ASTER	G5	S1	PE	PE
ASTER DEPAUPERATUS	SERPENTINE ASTER	G2	S2	PT	PT

ASTER DRUMMONDII	HAIRY HEART-LEAVED ASTER	G5	SH	N	PE
ASTER DUMOSUS	BUSHY ASTER	G5	S2	TU	TU
ASTER ERICOIDES	WHITE HEATH ASTER	G5	S3	TU	TU
ASTER NEMORALIS	BOG ASTER	G5	S1	PE	PE
ASTER NOVI-BELGII	NEW YORK ASTER	G5	S2	PT	PT
ASTER PRAEALTUS	VEINY-LINED ASTER	G5	S3	N	TU
ASTER PUNICEUS VAR FIRMUS	FIRM ASTER	G5T5	S2	TU	PT
ASTER RADULA	ROUGH-LEAVED ASTER	G5	S2	N	PT
ASTER SOLIDAGINEUS	NARROW-LEAVED WHITE-TOPPED ASTER	G5	S1	PE	PE
ASTER SPECTABILIS	LOW SHOWY ASTER	G5	S1	PE	PE
ASTRAGALUS CANADENSIS	CANADIAN MILKVETCH	G5	S2	N	TU
ASTRAGALUS NEGLECTUS	COOPER'S MILK-VETCH	G4	S1	PE	PE
BACCHARIS HALIMIFOLIA	EASTERN BACCHARIS	G5	S3	PR	PR
BAPTISIA AUSTRALIS	BLUE FALSE-INDIGO	G5	S3	N	TU
BARTONIA PANICULATA	SCREW-STEM	G5	S3	N	TU
BERBERIS CANADENSIS	AMERICAN BARBERRY	G3	SX	PX	PX
BIDENS BIDENTOIDES	SWAMP BEGGAR-TICKS	G3	S1	PT	PE
BIDENS DISCOIDEA	SMALL BEGGAR-TICKS	G5	S3	N	PR
BIDENS LAEVIS	BEGGAR-TICKS	G5	S3	N	TU
BOLTONIA ASTEROIDES	ASTER-LIKE BOLTONIA	G5	S1	PE	PE
BOUTELOUA CURTIPENDULA	TALL GRAMMA	G5	S2	PT	PT
BROMUS KALMII	BROME GRASS	G5	S3	N	TU
BUCHNERA AMERICANA	BLUEHEARTS	G5?	SX	PX	PX
CACALIA MUEHLENBERGII	GREAT INDIAN-PLANTAIN	G4	S1	N	PE
CAKILE EDENTULA	AMERICAN SEA-ROCKET	G5	S3	PR	PR
CALYCANTHUS FLORIDUS VAR LAEVIGATUS	SWEET-SHRUB	G5T5Q	SH	N	TU
CAMASSIA SCILLOIDES	WILD HYACINTH	G4G5	S1	PT	PE
CARDAMINE MAXIMA	LARGE TOOTHWORT	G5Q	S1	N	TU
CARDAMINE PRATENSIS VAR PALUSTRIS	CUCKOOFLOWER	G5T5	S1	PE	TU
CAREX ADUSTA	CROWDED SEDGE	G5	SX	PX	PX
CAREX ALATA	BROAD-WINGED SEDGE	G5	S2	PT	PT
CAREX AQUATILIS	WATER SEDGE	G5	S2	PT	PT
CAREX ATHERODES	AWNED SEDGE	G5	S1	PE	PE

CAREX AUREA	GOLDEN-FRUITED SEDGE	G5	S1	PE	PE
CAREX BACKII	ROCKY MOUNTAIN SEDGE	G4	SX	PX	PX
CAREX BARRATTII	BARRATT'S SEDGE	G4	SX	PX	PX
CAREX BEBBII	BEBB'S SEDGE	G5	S1	PE	PE
CAREX BICKNELLII	BICKNELL'S SEDGE	G5	S1	PE	PE
CAREX BREVIOR	A SEDGE	G5?	S2?	N	TU
CAREX BULLATA	BULL SEDGE	G5	S1	PE	PE
CAREX BUXBAUMII	BROWN SEDGE	G5	S3	TU	PR
CAREX CAREYANA	CAREY'S SEDGE	G5	S1	PE	PE
CAREX CHORDORRHIZA	CREEPING SEDGE	G5	SX	PX	PX
CAREX COLLINSII	COLLIN'S SEDGE	G4	S2	PE	PT
CAREX CRAWFORDII	CRAWFORD'S SEDGE	G5	S1	TU	PE
CAREX CRINITA VAR BREVICRINIS	SHORT HAIR SEDGE	G5T5	S1	PE	PE
CAREX CRYPTOLEPIS	NORTHEASTERN SEDGE	G4	S1	PT	PE
CAREX DIANDRA	LESSER PANICLED SEDGE	G5	S2	PT	PT
CAREX DISPERMA	SOFT-LEAVED SEDGE	G5	S3	PR	PR
CAREX EBURNEA	EBONY SEDGE	G5	S1	PE	PE
CAREX FLAVA	YELLOW SEDGE	G5	S2	PT	PT
CAREX FOENEA	A SEDGE	G5	S1	PE	PE
CAREX FORMOSA	HANDSOME SEDGE	G4	S1	PE	PE
CAREX GARBERI	ELK SEDGE	G4	S1	PE	PE
CAREX GEYERI	GEYER'S SEDGE	G5	S1	PE	PE
CAREX HAYDENII	CLOUD SEDGE	G5	S1S2	TU	PT
CAREX HYALINOLEPIS	SHORE-LINE SEDGE	G4G5	SX	PX	PX
CAREX LASIOCARPA	SLENDER SEDGE	G5	S3	PR	PR
CAREX LIMOSA	MUD SEDGE	G5	S2	TU	PT
CAREX LONGII	LONG'S SEDGE	G5	SU	TU	TU
CAREX LUPULIFORMIS	FALSE HOP SEDGE	G4	S1	TU	TU
CAREX MEADII	MEAD'S SEDGE	G4G5	S1	TU	PE
CAREX MITCHELLIANA	MITCHELL'S SEDGE	G3G4	S1	PE	PE
CAREX OLIGOSPERMA	FEW-SEEDED SEDGE	G4	S2	PT	PT
CAREX ORMOSTACHYA	SPIKE SEDGE	G4	S2	N	TU
CAREX PAUCIFLORA	FEW-FLOWERED SEDGE	G5	S1	PE	PE
CAREX PAUPERCULA	BOG SEDGE	G5	S3	PT	PR
CAREX POLYMORPHA	VARIABLE SEDGE	G3	S2	PE	PT
CAREX PRAIREA	PRAIRIE SEDGE	G5?	S2	PT	PT
CAREX PSEUDOCYPERUS	CYPERUS-LIKE SEDGE	G5	S1	PE	PE
CAREX RETRORSA	BACKWARD SEDGE	G5	S1	PE	PE
CAREX RICHARDSONII	RICHARDSON'S SEDGE	G4	S1	N	PE
CAREX SARTWELLII	SARTWELL'S SEDGE	G4G5	SX	PX	PX

CAREX SCHWEINITZII	SCHWEINITZ'S SEDGE	G3	S1	PT	PE
CAREX SHORTIANA	SEDGE	G5	S3	N	PR
CAREX SICCATA	A SEDGE	G5	S2	N	TU
CAREX SPRENGELII	SEDGE	G5?	S3	N	PR
CAREX STERILIS	STERILE SEDGE	G4	S1	PT	PE
CAREX TETANICA	A SEDGE	G4G5	S2	PT	PT
CAREX TYPHINA	CATTAIL SEDGE	G5	S2	PE	PT
CAREX VIRIDULA	GREEN SEDGE	G5	S1	PE	PE
CAREX WIEGANDII	WIEGANDS SEDGE	G3	S1	PT	PT
CASTILLEJA COCCINEA	SCARLET INDIAN-PAINTBRUSH	G5	S2	TU	PT
CERASTIUM ARVENSE VAR VILLOSISSIMUM	SERPENTINE CHICKWEED	G5T1Q	S1	PE	PE
CHAMAECYPARIS THYOIDES	ATLANTIC WHITE CEDAR	G4	SX	PX	PX
CHAMAESYCE POLYGONIFOLIA	SMALL SEA-SIDE SPURGE	G5?	S2	PT	PT
CHASMANTHIUM LATIFOLIUM	WILD OAT	G5	S1	TU	PE
CHASMANTHIUM LAXUM	SLENDER SEA-OATS	G5	S1	PE	PE
CHENOPODIUM CAPITATUM	STRAWBERRY GOOSEFOOT	G5	SH	TU	TU
CHENOPODIUM FOGGII	FOGG'S GOOSEFOOT	G3Q	S1	PE	PE
CHIONANTHUS VIRGINICUS	FRINGE-TREE	G5	S3	N	PT
CHRYSOGONUM VIRGINIANUM	GREEN-AND-GOLD	G5	S1	PE	PE
CHRYSOPSIS MARIANA	MARYLAND GOLDEN-ASTER	G5	S1	PT	PE
CIMICIFUGA AMERICANA	MOUNTAIN BUGBANE	G4	S3	PT	PR
CIRSIUM HORRIDULUM	HORRIBLE THISTLE	G5	S1	PE	PE
CLADIUM MARISCOIDES	TWIG RUSH	G5	S2	PE	PE
CLEMATIS VIORNA	VASE-VINE LEATHER-FLOWER	G5	S1	PE	PE
CLETHRA ACUMINATA	MOUNTAIN PEPPER-BUSH	G4	S1	PE	PE
CLITORIA MARIANA	BUTTERFLY-PEA	G5	S1	PE	PE
COELOGLOSSUM VIRIDE	LONG-BRACTED GREEN ORCHID	G5	SH	TU	TU
COMMELINA ERECTA	SLENDER DAY-FLOWER	G5	SX	PX	PX
COMMELINA VIRGINICA	VIRGINIA DAY-FLOWER	G5	SX	PX	PX
CONIOSELINUM CHINENSE	HEMLOCK-PARSLEY	G5	S1	PE	PE

CORALLORHIZA WISTERIANA	SPRING CORAL-ROOT	G5	S1	TU	PE
COREOPSIS ROSEA	PINK TICKSEED	G3	SX	PX	PX
CORYDALIS AUREA	GOLDEN CORYDALIS	G5	S1	N	PE
CRASSULA AQUATICA	WATER PIGMY-WEED	G5	SX	PX	PX
CRATAEGUS BRAINERDII	BRAINERD'S HAWTHORNE	G5	SU	TU	TU
CRATAEGUS DILATATA	A HAWTHORN	G4	SU	N	TU
CRATAEGUS MOLLIS	DOWNY HAWTHORNE	G5	SU	TU	TU
CRATAEGUS PENNSYLVANICA	RED-FRUITED HAWTHORN	G3Q	S2S3	N	TURF
CRITESION PUSILLUM	LITTLE BARLEY	G5	SH	PX	PX
CROTONOPSIS ELLIPTICA	ELLIPTICAL RUSHFOIL	G5	SX	PX	PX
CRYPTOGRAMMA STELLERI	SLENDER ROCK-BRAKE	G5	S1	PE	PE
CUSCUTA CAMPESTRIS	DODDER	G5T5	S2	N	TU
CUSCUTA CEPHALANTHI	BUTTON-BUSH DODDER	G5	SU	TU	TU
CUSCUTA COMPACTA	DODDER	G5	S3	N	TU
CUSCUTA CORYLI	HAZEL DODDER	G5	SU	TU	TU
CUSCUTA PENTAGONA	FIELD DODDER	G5	S3	N	TU
CUSCUTA POLYGONORUM	SMARTWEED DODDER	G5	SU	TU	TU
CYMOPHYLLUS FRASERIANUS	FRASER'S SEDGE	G4	S1	PE	PE
CYNANCHUM LAEVE	SMOOTH SWALLOW-WORT	G5	SU	PE	PE
CYNOGLOSSUM BOREALE	NORTHERN HOUND'S-TONGUE	G4	SH	PX	PX
CYPERUS DIANDRUS	UMBRELLA FLATSEDGE	G5	S2	PE	PE
CYPERUS HOUGHTONII	HOUGHTON'S FLATSEDGE	G4?	S1	PE	PE
CYPERUS LANCASTRIENSIS	MANY-FLOWERED UMBRELLA SEDGE	G5	S2	N	TU
CYPERUS POLYSTACHYOS	MANY-SPIKED FLATSEDGE	G5	SX	PX	PX
CYPERUS REFRACTUS	REFLEXED FLATSEDGE	G5	S1	PE	PE
CYPERUS RETRORSUS	RETRORSE FLATSEDGE	G5	SH	PE	PX
CYPERUS SCHWEINITZII	SCHWEINITZ'S FLATSEDGE	G5	S2	PR	PR
CYPRIPEDIUM CALCEOLUS VAR PARVIFLORUM	SMALL YELLOW LADY'S-SLIPPER	G5	S1	PE	PE

CYPRIPEDIUM CANDIDUM	SMALL WHITE LADY'S-SLIPPER	G4	SX	PX	PX
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	G4	S2	PT	PT
CYSTOPTERIS LAURENTIANA	LAURENTIAN BLADDER-FERN	G3	S1	TU	PE
CYSTOPTERIS TENNESSEENSIS	BLADDER FERN	G5	S1	N	TU
DELPHINIUM EXALTATUM	TALL LARKSPUR	G3	S1	PE	PE
DESCHAMPSIA CESPITOSA	TUFTED HAIRGRASS	G5	S3	N	TU
DESMODIUM GLABELLUM	TALL TICK-TREFOIL	G5	SU	TU	TU
DESMODIUM LAEVIGATUM	SMOOTH TICK-TREFOIL	G5	SU	N	TU
DESMODIUM NUTTALLII	NUTTALLS' TICK-TREFOIL	G5	S2	TU	TU
DESMODIUM OBTUSUM	STIFF TICK-TREFOIL	G4G5	SU	N	TU
DESMODIUM SESSILIFOLIUM	SESSILE-LEAVED TICK-TREFOIL	G5	SX	PX	PX
DESMODIUM VIRIDIFLORUM	VELVETY TICK-TREFOIL	G5?	SU	N	TU
DIARRHENA OBOVATA	AMERICAN BEAKGRAIN	G4G5	S1	PE	PR
DICENTRA EXIMIA	WILD BLEEDING-HEARTS	G4	S1	PE	PE
DIPHASIASTRUM SABINIFOLIUM	FIR CLUBMOSS	G4	SX	PX	PX
DODECATHEON MEADIA	COMMON SHOOTING-STAR	G5	S1	PE	PE
DODECATHEON RADICATUM	JEWELED SHOOTING-STAR	G?	S2	PT	PT
DRABA REPTANS	CAROLINA WHITLOW-GRASS	G5	SH	PX	PX
DRACOCEPHALUM PARVIFLORUM	AMERICAN DRAGONHEAD	G5	SH	TU	TU
DRYOPTERIS CAMPYLOPTERA	MOUNTAIN WOOD FERN	G5	S1	PE	PE
DRYOPTERIS CELSA	LOG FERN	G4	S1	N	PE
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	G5	S2	N	PT
ECHINACEA LAEVIGATA	SMOOTH CONEFLOWER	G2	SX	PX	PX
ECHINOCHLOA WALTERI	WALTER'S BARNYARD-GRASS	G5	S1	PE	PE
ELATINE AMERICANA	LONG-STEMMED WATER-WORT	G4	SH	PX	PE
ELEOCHARIS CARIBAEA	CAPITATE SPIKE-RUSH	G4G5	S1	PE	PE

ELEOCHARIS COMPRESSA	FLAT-STEMMED SPIKE-RUSH	G4	S1	PE	PE
ELEOCHARIS ELLIPTICA	SLENDER SPIKE-RUSH	G5	S2	PE	PE
ELEOCHARIS INTERMEDIA	MATTED SPIKE-RUSH	G5	S2	PT	PT
ELEOCHARIS OBTUSA VAR PEASEI	WRIGHTS SPIKE RUSH	G5T5	S1	PE	PE
ELEOCHARIS PARVULA	LITTLE-SPIKE SPIKE-RUSH	G5	S1	PE	PE
ELEOCHARIS PAUCIFLORA VAR FERNALDII	FEW-FLOWERED SPIKE-RUSH	G5T?Q	S1	PE	PE
ELEOCHARIS QUADRANGULATA	FOUR-ANGLED SPIKE-RUSH	G4	S1	PE	PE
ELEOCHARIS ROBBINSII	ROBBINS' SPIKE-RUSH	G4G5	S2	PT	PT
ELEOCHARIS ROSTELLATA	BEAKED SPIKE-RUSH	G5	S1	PE	PE
ELEOCHARIS TENUIS VAR VERRUCOSA	SLENDER SPIKE-RUSH	G5T3T5	S1	PE	PE
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH	G4	SX	PX	PX
ELEOCHARIS TUBERCULOSA	LONG-TUBERCLED SPIKE-RUSH	G5	SX	PX	PX
ELEPHANTOPUS CAROLINIANUS	ELEPHANT'S FOOT	G5	S1	PE	PE
ELLISIA NYCTELEA	ELLISIA	G5	S2	PT	PT
ELODEA SCHWEINITZII	SCHWEINITZ'S WATERWEED	GHQ	SX	PX	PX
ELYMUS TRACHYCAULUS	SLENDER WHEATGRASS	G5	S3	N	TU
EPILOBIUM PALUSTRE	MARSH WILLOW-HERB	G5	S1	TU	TU
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	G5?	S3	PE	PR
EQUISETUM VARIEGATUM	VARIEGATED HORSETAIL	G5	S1	PE	PE
EQUISETUM X FERRISSII	SCOURING-RUSH	HYB	S1	N	PE
ERIANTHUS GIGANTEUS	SUGAR CANE PLUMEGRASS	G5	SX	PX	PX
ERIGENIA BULBOSA	HARBINGER-OF-SPRING	G5	S2	PT	PT
ERIOCAULON DECANGULARE	TEN-ANGLE PIPEWORT	G5	SX	PX	PX
ERIOCAULON PARKERI	PARKER'S PIPEWORT	G3	SX	PX	PX
ERIOPHORUM GRACILE	SLENDER COTTON-GRASS	G5	S1	PE	PE

ERIOPHORUM TENELLUM	ROUGH COTTON-GRASS	G5	S1	PE	PE
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	G5	S2	PT	PT
ERYNGIUM AQUATICUM	MARSH ERYNGO	G4	SX	PX	PX
ERYTHRONIUM ALBIDUM	WHITE TROUT-LILY	G5	S3	N	TU
EUPATORIUM ALBUM	WHITE THOROUGHWORT	G5	SH	PX	PX
EUPATORIUM AROMATICUM	SMALL WHITE-SNAKEROOT	G5	S3	N	PR
EUPATORIUM COELESTINUM	MISTFLOWER	G5	S3	N	TU
EUPATORIUM GODFREYANUM	VASEY'S EUPATORIUM	G4	S2	N	TU
EUPATORIUM LEUCOLEPIS	WHITE-BRACTED THOROUGHWORT	G5	SX	PX	PX
EUPATORIUM ROTUNDIFOLIUM	A EUPATORIUM	G5	S3	TU	UTF
EUPHORBIA IPECACUANHAE	WILD IPECAC	G5?	S1	PE	PE
EUPHORBIA OBTUSATA	BLUNT-LEAVED SPURGE	G5	S1	PE	PE
EUPHORBIA PURPUREA	GLADE SPURGE	G3	S1	PE	PE
EUTHAMIA TENUIFOLIA	GRASS-LEAVED GOLDENROD	G5	S1	PT	PT
FESTUCA PARADOXA	CLUSTER FESCUE	G5	S1	PE	PE
FILIPENDULA RUBRA	QUEEN-OF-THE-PRAIRIE	G4G5	S1S2	TU	TU
FIMBRISTYLIS ANNUA	ANNUAL FIMBRY	G5	S2	PT	PT
FIMBRISTYLIS PUBERULA	HAIRY FIMBRY	G5	SX	PX	PX
FRAXINUS PROFUNDA	PUMPKIN ASH	G4	S1	N	PE
GALACTIA REGULARIS	EASTERN MILK-PEA	G5	SX	PX	PX
GALACTIA VOLUBILIS	DOWNY MILK-PEA	G5	SX	PX	PX
GALIUM LABRADORICUM	LABRADOR MARSH BEDSTRAW	G5	S1	PE	PE
GALIUM LATIFOLIUM	PURPLE BEDSTRAW	G5	S3	N	TU
GALIUM TRIFIDUM	MARSH BEDSTRAW	G5	S2	N	PR
GAULTHERIA HISPIDULA	CREEPING SNOWBERRY	G5	S3	PR	PR
GAYLUSSACIA BRACHYCERA	BOX HUCKLEBERRY	G2G3	S1	PT	PE
GAYLUSSACIA DUMOSA	DWARF HUCKLEBERRY	G5	SH	PE	PE
GENTIANA ALBA	YELLOW GENTIAN	G4	SH	TU	PX

GENTIANA CATESBAEI	ELLIOTT'S GENTIAN	G5	SX	PX	PX
GENTIANA LINEARIS	NARROW-LEAVED GENTIAN	G4G5	S3	N	PR
GENTIANA SAPONARIA	SOAPWORT GENTIAN	G5	S1S2	TU	PE
GENTIANA VILLOSA	STRIPED GENTIAN	G4	S1	TU	PE
GENTIANOPSIS VIRGATA	LESSER FRINGED GENTIAN	G5	SX	PX	PX
GERANIUM BICKNELLII	CRANESBILL	G5	S1	PE	PE
GLYCERIA BOREALIS	SMALL-FLOATING MANNA-GRASS	G5	S2	PE	PT
GLYCERIA OBTUSA	BLUNT MANNA-GRASS	G5	S1	PE	PE
GNAPHALIUM SYLVATICUM	CUDWEED	G5	SH	N	TU
GOODYERA REPENS	LESSER RATTLESNAKE-PLANTAIN	G5	S2	N	TU
GOODYERA TESSELATA	CHECKERED RATTLESNAKE-PLANTAIN	G5	S1	TU	PT
GRATIOLA AUREA	GOLDEN HEDGE-HYSSOP	G5	S1	TU	PE
GYMNOCARPIUM APPALACHIANUM	APPALACHIAN OAK FERN	G3	S1	TU	PE
GYMNOCARPIUM X HETEROSPORUM	A FERN HYBRID (STERILE TRIPLOID)	HYB	SX	N	PX
GYMNOPOGON AMBIGUUS	BROAD-LEAVED BEARDGRASS	G4	SX	PE	PX
HELIANTHEMUM BICKNELLII	BICKNELL'S HOARY ROCKROSE	G5	S2	PE	PE
HELIANTHEMUM PROPINQUUM	LOW ROCKROSE	G4	SU	N	TU
HELIANTHUS ANGUSTIFOLIUS	SWAMP SUNFLOWER	G5	SX	PX	PX
HELIANTHUS HIRSUTUS	SUNFLOWER	G5	S2	N	TU
HELIANTHUS MICROCEPHALUS	SMALL WOOD SUNFLOWER	G5	S3	N	TU
HELIANTHUS OCCIDENTALIS	SUNFLOWER	G5	SH	N	PX
HETERANTHERA MULTIFLORA	MULTIFLOWERED MUD-PLANTAIN	G4	S1	PE	PE
HIERACIUM KALMII	CANADA HAWKWEED	G5	S3	N	TU
HIERACIUM TRAILLII	MARYLAND HAWKWEED	G4	S1	PE	PE
HIEROCHLOE ODORATA	VANILLA SWEET-GRASS	G5	S1	PE	PE
HOTTONIA INFLATA	AMERICAN FEATHERFOIL	G4	SX	PX	PX
HOUSTONIA PURPUREA VAR PURPUREA	PURPLE BLUETS	G5T5	SU	TU	TU

HOUSTONIA SERPYLLIFOLIA	CREEPING BLUETS	G4?	S1	N	PE
HUPERZIA POROPHILA	ROCK CLUBMOSS	G4	S1	PE	PE
HYDROCOTYLE UMBELLATA	MANY-FLOWERED PENNYWORT	G5	SH	PX	PX
HYDROPHYLLUM MACROPHYLLUM	LARGE-LEAVED WATERLEAF	G5	S1	PE	PE
HYPERICUM ADPRESSUM	CREEPING ST. JOHN'S-WORT	G2G3	SX	PX	PX
HYPERICUM CRUX-ANDREAE	ST PETER'S-WORT	G5	SX	PX	PX
HYPERICUM DENSIFLORUM	BUSHY ST. JOHN'S-WORT	G5	S2	PT	PR
HYPERICUM DENTICULATUM	COPPERY ST. JOHN'S-WORT	G5	SX	PX	PX
HYPERICUM DRUMMONDII	NITS-AND-LICE	G5	SX	TU	PX
HYPERICUM GYMNANTHUM	CLASPING-LEAVED ST. JOHN'S-WORT	G4	S1	PX	PE
HYPERICUM MAJUS	LARGER CANADIAN ST. JOHN'S-WORT	G5	S2	PT	PT
HYPERICUM STRAGULUM	ST ANDREW'S-CROSS	G5	S2	N	TU
ILEX GLABRA	INK-BERRY	G5	SX	PX	PX
ILEX OPACA	AMERICAN HOLLY	G5	S2	PT	PT
IODANTHUS PINNATIFIDUS	PURPLE ROCKET	G5	S1	PE	PE
IRIS CRISTATA	CRESTED DWARF IRIS	G5	S1	PE	PE
IRIS PRISMATICA	SLENDER BLUE IRIS	G4G5	S1	PE	PE
IRIS VERNA	DWARF IRIS	G5	S1	PE	PE
IRIS VIRGINICA	VIRGINIA BLUE FLAG	G5	S2	N	PE
ISOETES VALIDA	QUILLWORT	G4?	SU	N	TU
ISOETES X BRITTONII	QUILLWORT	HYB	SU	N	TU
ISOTRIA MEDEOLOIDES	SMALL-WHORLED POGONIA	G2	S1	PE	PE
ITEA VIRGINICA	VIRGINIA WILLOW	G4	S1	PX	PE
JUNCUS ALPINOARTICULATUS SSP NODULOSUS	RICHARDSON'S RUSH	G5T5?	S2	PT	PT
JUNCUS ARCTICUS VAR LITTORALIS	BALTIC RUSH	G5T5	S2	PT	PT
JUNCUS BIFLORUS	GRASS-LEAVED RUSH	G5	S2	TU	PT
JUNCUS BRACHYCARPUS	SHORT-FRUITED RUSH	G4G5	S1	PE	PE
JUNCUS BRACHYCEPHALUS	SMALL-HEADED RUSH	G5	S2	PT	PT
JUNCUS DEBILIS	WEAK RUSH	G5	S3	N	TU
JUNCUS DICHOTOMUS	FORKED RUSH	G5	S1	PE	PE

JUNCUS FILIFORMIS	THREAD RUSH	G5	S3	PR	PR
JUNCUS GREENEI	GREENE'S RUSH	G5	SX	PX	PX
JUNCUS MILITARIS	BAYONET RUSH	G4	S1	PE	PE
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH	G5	S1	PE	PE
JUNCUS TORREYI	TORREY'S RUSH	G5	S2	PT	PE
JUNIPERUS COMMUNIS	COMMON JUNIPER	G5	S2	N	TU
KOELERIA MACRANTHA	JUNEGRASS	G5	SX	PX	PX
LACTUCA HIRSUTA	DOWNY LETTUCE	G5?	S3	N	TU
LATHYRUS JAPONICUS	BEACH PEAVINE	G5	S2	PT	PT
LATHYRUS OCHROLEUCUS	WILD-PEA	G4G5	S1	PT	PT
LATHYRUS PALUSTRIS	VETCHLING	G5	S1	TU	PE
LATHYRUS VENOSUS	VEINY PEA	G5	S2	N	TU
LECHEA MINOR	THYME-LEAVED PINWEED	G5	SU	N	TU
LEDUM GROENLANDICUM	COMMON LABRADOR-TEA	G5	S3	PR	PR
LEIOPHYLLUM BUXIFOLIUM	SAND-MYRTLE	G4	SX	PX	PX
LEMNA OBSCURA	LITTLE WATER DUCKWEED	G5	SX	PX	PX
LEMNA PERPUSILLA	MINUTE DUCKWEED	G5	SU	N	TU
LEMNA TURIONIFERA	A DUCKWEED	G5	SU	TU	TU
LEMNA VALDIVIANA	PALE DUCKWEED	G5	SH	PX	PX
LESPEDEZA ANGUSTIFOLIA	NARROWLEAF BUSHCLOVER	G5	S1	PE	PE
LESPEDEZA STUEVEI	TALL BUSH CLOVER	G4?	SX	PX	PX
LEUCOTHOE RACEMOSA	SWAMP DOG-HOBBLE	G5	S2S3	TU	PT
LIATRIS SCARIOSA	ROUND-HEAD GAYFEATHER	G5?	S2	N	PT
LIGUSTICUM CANADENSE	NONDO LOVAGE	G4	SH	PE	PE
LIMOSELLA AUSTRALIS	AWL-SHAPED MUDWORT	G4G5	SX	PX	PX
LINNAEA BOREALIS	TWINFLOWER	G5	S1	PT	PE
LINUM INTERCURSUM	SANDPLAIN WILD FLAX	G4	S1	PE	PE
LINUM SULCATUM	GROOVED YELLOW FLAX	G5	S1	PE	PE
LIPOCARPHA MICRANTHA	COMMON HEMICARPA	G4	S1	PE	PE
LISTERA AUSTRALIS	SOUTHERN TWAYBLADE	G4	S1	PE	PE
LISTERA CORDATA	HEART-LEAVED TWAYBLADE	G5	S1	PE	PE
LISTERA SMALLII	KIDNEY-LEAVED TWAYBLADE	G4	S1	PE	PE

LITHOSPERMUM CANESCENS	HOARY PUCCOON	G5	S2	N	TU
LITHOSPERMUM CAROLINIENSE	HISPID GROMWELL	G4G5	S1	PE	PE
LITHOSPERMUM LATIFOLIUM	AMERICAN GROMWELL	G4	S3	PE	PR
LOBELIA DORTMANNA	WATER LOBELIA	G4	S2	PT	PT
LOBELIA KALMII	BROOK LOBELIA	G5	S1	PE	PE
LOBELIA NUTTALLII	NUTTALL'S LOBELIA	G4G5	SX	PX	PX
LOBELIA PUBERULA	DOWNY LOBELIA	G5	S1	PE	PE
LONICERA HIRSUTA	HAIRY HONEYSUCKLE	G4G5	S1	TU	PE
LONICERA OBLONGIFOLIA	SWAMP FLY HONEYSUCKLE	G4	S1	PE	PE
LONICERA VILLOSA	MOUNTAIN FLY HONEYSUCKLE	G5	S1	PE	PE
LUDWIGIA DECURRENS	UPRIGHT PRIMROSE-WILLOW	G5	S1	PE	PE
LUDWIGIA POLYCARPA	FALSE LOOSESTRIFE SEEDBOX	G4	S1	PE	PE
LUDWIGIA SPHAEROCARPA	SPHERICAL-FRUITED SEEDBOX	G5	SX	PX	PX
LUPINUS PERENNIS	LUPINE	G5	S3	PR	PR
LUZULA BULBOSA	SOUTHERN WOOD-RUSH	G5	S1	TU	PE
LYCOPODIELLA ALOPECUROIDES	FOXTAIL CLUBMOSS	G5	S1	PE	PE
LYCOPODIELLA APPRESSA	SOUTHERN BOG CLUBMOSS	G5	S2	PT	PT
LYCOPODIELLA MARGUERITAE	A CLUBMOSS	G2	SU	N	PE
LYCOPUS RUBELLUS	BUGLEWEED	G5	S1	PE	PE
LYGODIUM PALMATUM	HARTFORD FERN	G4	S3	PR	PR
LYONIA MARIANA	STAGGER-BUSH	G5	S1	PE	PE
LYSIMACHIA HYBRIDA	LANCE-LEAF LOOSESTRIFE	G5	S1	N	PT
LYSIMACHIA QUADRIFLORA	FOUR-FLOWERED LOOSESTRIFE	G5?	SX	TU	TU
LYTHRUM ALATUM	WINGED-LOOSESTRIFE	G5	S1	TU	PE
MAGNOLIA TRIPETALA	UMBRELLA MAGNOLIA	G5	S2	PT	PR
MAGNOLIA VIRGINIANA	SWEET BAY MAGNOLIA	G5	S2	PT	PT
MALAXIS BAYARDII	BAYARD'S MALAXIS	G2	S1	PR	PE
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	G4Q	S1	TU	PE
MARSHALLIA GRANDIFLORA	LARGE-FLOWERED MARSHALLIA	G2	S1	PE	PE
MATELEA OBLIQUA	OBLIQUE MILKVINE	G4?	S1	PE	PE

MEEHANIA CORDATA	HEARTLEAF MEEHANIA	G5	S1	TU	PE
MEGALODONTA BECKII	BECK'S WATER-MARIGOLD	G4G5	S1	PE	PE
MELANTHIUM VIRGINICUM	VIRGINIA BUNCHFLOWER	G5	SU	N	TU
MELICA NITENS	THREE-FLOWERED MELIC-GRASS	G5	S2	PT	PT
MENZIESIA PILOSA	MINNIEBUSH	G4G5	S3	PR	PR
MICRANTHEMUM MICRANTHEMOIDES	NUTTALL'S MUD-FLOWER	GH	SX	PX	PX
MINUARTIA GLABRA	APPALACHIAN SANDWORT	G4	S2	PT	PT
MITELLA NUDA	NAKED BISHOP'S-CAP	G5	S1	PE	PE
MONARDA PUNCTATA	SPOTTED BEE-BALM	G5	SH	PE	PE
MONTIA CHAMISSOI	CHAMISSO'S MINER'S-LETTUCE	G5	S1	PE	PE
MUHLENBERGIA CAPILLARIS	SHORT MUHLY	G5	SX	PX	PX
MUHLENBERGIA CUSPIDATA	PLAINS MUHLENBERGIA	G4	SE	TU	TU
MUHLENBERGIA UNIFLORA	FALL DROPSEED MUHLY	G5	S2	PE	PT
MYRICA GALE	SWEET-GALE	G5	S2	PT	PT
MYRIOPHYLLUM FARWELLII	FARWELL'S WATER-MILFOIL	G5	S1	PE	PE
MYRIOPHYLLUM HETEROPHYLLUM	BROAD-LEAVED WATER-MILFOIL	G5	S1	PE	PE
MYRIOPHYLLUM SIBIRICUM	NORTHERN WATER-MILFOIL	G5	S1	PE	PE
MYRIOPHYLLUM TENELLUM	SLENDER WATER-MILFOIL	G5	S2	PT	PT
MYRIOPHYLLUM VERTICILLATUM	WHORLED WATER-MILFOIL	G5	S1	PE	PE
NAJAS GRACILLIMA	BUSHY NAIAD	G5?	S2	PT	PT
NAJAS MARINA	HOLLY-LEAVED NAIAD	G5	S1	PE	PE
NELUMBO LUTEA	AMERICAN LOTUS	G4	S1	PE	PE
NUPHAR LUTEA SSP PUMILA	YELLOW COWLILY	G5T4T5	SU	TU	TU
NYMPHOIDES CORDATA	FLOATING-HEART	G5	S2	PT	PT
OENOTHERA ARGILLICOLA	SHALE-BARREN EVENING-PRIMROSE	G3G4	S2	PT	PT
OENOTHERA OAKESIANA	EVENING-PRIMROSE	G4G5Q	S2	N	TU
ONOSMODIUM MOLLE VAR HISPIDISSIMUM	FALSE GROMWELL	G4G5T4	S1	PE	PE
ONOSMODIUM VIRGINIANUM	VIRGINIA FALSE-GROMWELL	G4	SH	PX	PX

OPHIOGLOSSUM ENGELMANNII	LIMESTONE ADDER'S-TONGUE	G5	S1	PE	PE
OPHIOGLOSSUM VULGATUM	ADDER'S TONGUE	G5	S1	PX	PE
OPUNTIA HUMIFUSA	PRICKLY-PEAR CACTUS	G5	S3	PR	PR
ORYZOPSIS PUNGENS	SLENDER MOUNTAIN-RICEGRASS	G5	S2	PE	PE
OXYDENDRUM ARBOREUM	SOURWOOD	G5	S3S4	TU	PT
OXYPOLIS RIGIDIOR	STIFF COWBANE	G5	S3S4	TU	PT
PANICUM AMARUM VAR AMARULUM	SOUTHERN SEA-BEACH PANIC-GRASS	G5TU	SH	PE	PE
PANICUM ANNULUM	SERPENTINE PANIC-GRASS	G5T?	S2	TU	PT
PANICUM BICKNELLII	BICKNELL'S PANIC GRASS	G4?Q	SU	TU	TU
PANICUM BOREALE	PANIC-GRASS	G5	SU	TU	TU
PANICUM COMMONSIANUM VAR COMMONSIANUM	COMMONS' PANIC-GRASS	G5T5	SH	TU	PX
PANICUM COMMONSIANUM VAR EUCHLAMYDEUM	CLOAKED PANIC-GRASS	G5T5	S2	PR	PE
PANICUM FLEXILE	WIRY WITCHGRASS	G5	S2S3	TU	TU
PANICUM LAXIFLORUM	LAX-FLOWER WITCHGRASS	G5	S?	N	PE
PANICUM LEIBERGII	LEIBERG'S PANIC-GRASS	G5	SX	PX	PX
PANICUM LONGIFOLIUM	LONG-LEAF PANIC-GRASS	G4	SH	TU	PE
PANICUM LUCIDUM	SHINING PANIC-GRASS	G?Q	S1	TU	PE
PANICUM OLIGOSANTHES	HELLER'S WITCHGRASS	G5	S3	N	TU
PANICUM RECOGNITUM	FERNALD'S PANIC-GRASS	G4	SH	TU	TU
PANICUM SCOPARIUM	VELVETY PANIC-GRASS	G5	S1	PE	PE
PANICUM SPRETUM	EATON'S WITCHGRASS	G5	SH	PX	PE
PANICUM TUCKERMANII	TUCKERMAN'S PANIC-GRASS	G3G5	S2	PT	PT
PANICUM VILLOSISSIMUM VAR VILLOSISSIMUM	LONG-HAIRED PANIC-GRASS	G5T5	SH	TU	TU
PANICUM XANTHOPHYSUM	SLENDER PANIC-GRASS	G5	S1	PE	PE
PANICUM YADKINENSE	YADKIN RIVER PANIC-GRASS	G4?Q	S2	TU	TU
PARNASSIA GLAUCA	CAROLINA GRASS-OF-PARNASSUS	G5	S2	PE	PE
PARONYCHIA					

FASTIGIATA VAR NUTTALLII	FORKED-CHICKWEED	G5T3T5	S1S2	TU	PE
PARTHENIUM INTEGRIFOLIUM	AMERICAN FEVER-FEW	G5	SH	TU	PX
PASSIFLORA LUTEA	PASSION-FLOWER	G5	S1	PE	PE
PAXISTIMA CANBYI	CANBY'S MOUNTAIN-LOVER	G2	S1	PE	PE
PEDICULARIS LANCEOLATA	SWAMP LOUSEWORT	G5	S1S2	N	PE
PENSTEMON CANESCENS	BEARD-TONGUE	G4	S3	N	TU
PENSTEMON LAEVIGATUS	BEARD-TONGUE	G5	S3	N	TU
PHASEOLUS POLYSTACHIOS	WILD KIDNEY BEAN	G4	S1S2	N	TU
PHEMERANTHUS TERETIFOLIUS	ROUND-LEAVED FAME-FLOWER	G4	S2	PT	PT
PHLOX OVATA	MOUNTAIN PHLOX	G4	S1	PE	PE
PHLOX PILOSA	DOWNY PHLOX	G5	S1S2	TU	PE
PHLOX SUBULATA SSP BRITTONII	MOSS PINK	G5T4?	S1	PE	PE
PHORADENDRON LEUCARPUM	CHRISTMAS MISTLETOE	G5	SX	PX	PX
PHYLA LANCEOLATA	LANCE FOG-FRUIT	G5	S2	TU	PR
PHYLLANTHUS CAROLINIENSIS	CAROLINA LEAF-FLOWER	G5	S1	PE	PE
PHYSALIS VIRGINIANA	VIRGINIA GROUND-CHERRY	G5	S1S2	TU	PE
PINUS ECHINATA	SHORT-LEAF PINE	G5	S1S2	N	TU
PIPTOCHAETIUM AVENACEUM	BLACKSEED NEEDLEGRASS	G5	S1	N	PE
PLATANTHERA BLEPHARIGLOTTIS	WHITE FRINGED-ORCHID	G4G5	S2S3	N	TU
PLATANTHERA CILIARIS	YELLOW-FRINGED ORCHID	G5	S2	TU	PT
PLATANTHERA CRISTATA	CRESTED YELLOW ORCHID	G5	SX	PX	PX
PLATANTHERA DILATATA	LEAFY WHITE ORCHID	G5	S1	PE	PE
PLATANTHERA HOOKERI	HOOKER'S ORCHID	G5	S1	TU	PE
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	G5	S1	PE	PE
PLATANTHERA LEUCOPHAEA	PRAIRIE WHITE-FRINGED ORCHID	G2	SX	PX	PX
PLATANTHERA PERAMOENA	PURPLE-FRINGELESS ORCHID	G5	S2	TU	PT
PLUCHEA ODORATA	SHRUBBY CAMPHOR-WEED	G5	S1	TU	PE
POA AUTUMNALIS	AUTUMN BLUEGRASS	G5	S1	PE	PE

POA LANGUIDA	DROOPING BLUEGRASS	G3G4Q	S2	TU	PT
POA PALUDIGENA	BOG BLUEGRASS	G3	S3	PT	PR
POLEMONIUM VANBRUNTIAE	JACOB'S-LADDER	G3	S1	PE	PE
POLYGALA CRUCIATA	CROSS-LEAVED MILKWORT	G5	S1	PE	PE
POLYGALA CURTISSII	CURTIS'S MILKWORT	G5	S1	PE	PE
POLYGALA INCARNATA	PINK MILKWORT	G5	SH	PE	PE
POLYGALA LUTEA	YELLOW MILKWORT	G5	SX	PX	PX
POLYGALA NUTTALLII	NUTTALL'S MILKWORT	G5	S3	N	TU
POLYGALA POLYGAMA	RACEMED MILKWORT	G5	S1S2	TU	PE
POLYGONELLA ARTICULATA	EASTERN JOINTWEED	G5	S1	TU	PE
POLYGONUM AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	G5T5	S2	TU	TU
POLYGONUM CAREYI	CAREY'S SMARTWEED	G4	S1	PE	PE
POLYGONUM RAMOSISSIMUM	BUSHY KNOTWEED	G5	SH	TU	PX
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	G5T4	S2	PE	PE
POLYMNIA UVEDALIA	LEAF-CUP	G4G5	SR	N	PT
POLYSTICHUM BRAUNII	BRAUN'S HOLLY FERN	G5	S1	PE	PE
POPULUS BALSAMIFERA	BALSAM POPLAR	G5	S1	PE	PE
POPULUS HETEROPHYLLA	SWAMP COTTONWOOD	G5	SX	PX	PX
POTAMOGETON BICUPULATUS	PONDWEED	G4?	S2	N	TU
POTAMOGETON CONFERVOIDES	TUCKERMAN'S PONDWEED	G4	S2	PT	PT
POTAMOGETON FILIFORMIS	SLENDER PONDWEED	G5	SH	TU	PX
POTAMOGETON FRIESII	FRIES' PONDWEED	G4	S1	PE	PE
POTAMOGETON GRAMINEUS	GRASSY PONDWEED	G5	SH	PE	PE
POTAMOGETON HILLII	HILL'S PONDWEED	G3	S1	PE	PE
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	G5	S3S4	TU	PR
POTAMOGETON OAKESIANUS	OAKES' PONDWEED	G4	S1S2	TU	PE

POTAMOGETON OBTUSIFOLIUS	BLUNT-LEAVED PONDWEED	G5	S1	PE	PE
POTAMOGETON PRAELONGUS	WHITE-STEMMED PONDWEED	G5	SH	PX	PE
POTAMOGETON PULCHER	SPOTTED PONDWEED	G5	S1	PE	PE
POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	G5	S3	PT	PR
POTAMOGETON STRICTIFOLIUS	NARROW-LEAVED PONDWEED	G5	SH	PE	PE
POTAMOGETON TENNESSEENSIS	TENNESSEE PONDWEED	G2	S1	PE	PE
POTAMOGETON VASEYI	VASEY'S PONDWEED	G4	S1	PE	PE
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	G5	S2S3	PR	PR
POTENTILLA ANSERINA	SILVERWEED	G5	S3	PT	PR
POTENTILLA FRUTICOSA	SHRUBBY CINQUEFOIL	G5	S1	PE	PE
POTENTILLA PARADOXA	BUSHY CINQUEFOIL	G5	S1	PE	PE
POTENTILLA TRIDENTATA	THREE-TOOTHED CINQUEFOIL	G5	S1	PE	PE
PRENANTHES RACEMOSA	GLAUCOUS RATTLESNAKE-ROOT	G5	SR	PX	PX
PRENANTHES SERPENTARIA	LION'S-FOOT	G5	S3	N	TU
PROSERPINACA PECTINATA	COMB-LEAVED MERMAID-WEED	G5	SX	PX	PX
PRUNUS ALLEGHANIENSIS	ALLEGHANY PLUM	G4	S2S3	N	PT
PRUNUS MARITIMA	BEACH PLUM	G4	S1	PE	PE
PRUNUS PUMILA VAR DEPRESSA		G5T5	S1		PE
PRUNUS PUMILA VAR PUMILA		G5T4	SX		PX
PRUNUS PUMILA VAR SUSQUEHANAE		G5T4	S2		PT
PTELEA TRIFOLIATA	COMMON HOP-TREE	G5	S2	PT	PT
PTILIMNIUM CAPILLACEUM	MOCK BISHOP-WEED	G5	SX	PE	PX
PYCNANTHEMUM CLINOPODIOIDES	MOUNTAIN-MINT	G2	S1S2	N	TUEF
PYCNANTHEMUM TORREI	TORREY'S MOUNTAIN-MINT	G2	SU	PE	PE
PYCNANTHEMUM VERTICILLATUM VAR PILOSUM	HAIRY MOUNTAIN-MINT	G5T5	SU	TU	PX

PYROLA CHLORANTHA		G5	S1	N	TU
PYRULARIA PUBERA	BUFFALO-NUT	G5	S3	PR	PR
QUERCUS FALCATA	SOUTHERN RED OAK	G5	S1	PE	PE
QUERCUS PHELLOS	WILLOW OAK	G5	S2	PE	PE
QUERCUS SHUMARDII	SHUMARD'S OAK	G5	S1	PE	PE
RANUNCULUS AMBIGENS		G4	S3	N	TURF
RANUNCULUS AQUATILIS VAR DIFFUSUS	WHITE WATER-CROWFOOT	G5T5	S3		PR
RANUNCULUS FASCICULARIS	TUFTED BUTTERCUP	G5	S1S2	PE	PE
RANUNCULUS FLABELLARIS	YELLOW WATER-CROWFOOT	G5	S2	N	PT
RANUNCULUS FLAMMULA	LESSER SPEARWORT	G5	SH	TU	PX
RANUNCULUS HEDERACEUS	LONG-STALKED CROWFOOT	G5	SX	PX	PX
RANUNCULUS PUSILLUS	SPEARWORT	G5	S1	N	PE
RATIBIDA PINNATA	GRAY-HEADED PRAIRIE CONEFLOWER	G5	SA?	TU	PX
RHAMNUS LANCEOLATA	LANCE-LEAVED BUCKTHORN	G5	S1	PE	PE
RHEXIA MARIANA	MARYLAND MEADOW-BEAUTY	G5	S1	PE	PE
RHODODENDRON ATLANTICUM	DWARF AZALEA	G4G5	S1	PE	PE
RHODODENDRON CALENDULACEUM	FLAME AZALEA	G5	SX	PX	PX
RHYNCHOSPORA CAPILLACEA	CAPILLARY BEAKED-RUSH	G5	S1	PE	PE
RHYNCHOSPORA FUSCA	BROWN BEAKED-RUSH	G4G5	SX	PX	PX
RHYNCHOSPORA GLOBULARIS	SMALL GLOBE BEAKED-RUSH	G5	S1	TU	PE
RHYNCHOSPORA GRACILENTA	BEAKED-RUSH	G5	SX	PX	PX
RIBES LACUSTRE	SWAMP CURRANT	G5	S1	TU	PE
RIBES MISSOURIENSE	MISSOURI GOOSEBERRY	G5	S1	PE	PE
RIBES TRISTE	RED CURRANT	G5	S2	PT	PT
ROSA BLANDA		G5	SU	N	TUTFN
ROSA SETIGERA		G5	SU	N	TUEN
ROSA VIRGINIANA	VIRGINIA ROSE	G5	S1	TU	TU
ROTALA RAMOSIOR	TOOTH-CUP	G5	S3	PR	PR
RUBUS CUNEIFOLIUS	SAND BLACKBERRY	G5	S1	TU	PE
RUBUS SETOSUS	SMALL BRISTLEBERRY	G5	SH	TU	TU
RUDBECKIA FULGIDA	EASTERN CONEFLOWER	G5	S3	N	TU

RUELLIA CAROLINIENSIS	CAROLINA PETUNIA	G5	SX	PX	PX
RUELLIA HUMILIS	FRINGED-LEAVED PETUNIA	G5	S1	PE	PE
RUELLIA PEDUNCULATA	STALKED WILD-PETUNIA	G5	S1	N	TU
RUELLIA STREPENS	LIMESTONE PETUNIA	G4G5	S2	PT	PT
RUMEX HASTATULUS	HEART-WINGED SORRELL	G5	SX	TU	PX
SABATIA CAMPANULATA	SLENDER MARSH PINK	G5	SX	PX	PX
SAGITTARIA CALYCINA VAR SPONGIOSA	LONG-LOBED ARROW-HEAD	G5T4	S1	PE	PE
SAGITTARIA FILIFORMIS	AN ARROW-HEAD	G4G5	SX	PX	PX
SAGITTARIA SUBULATA	SUBULATE ARROWHEAD	G4	S3	PR	PR
SALIX CANDIDA	HOARY WILLOW	G5	S1	PT	PE
SALIX CAROLINIANA	CAROLINA WILLOW	G5	S1	N	PE
SALIX MYRICOIDES	BROAD-LEAVED WILLOW	G4	S2	N	TU
SALIX PEDICELLARIS	BOG WILLOW	G5	S1	N	PE
SALIX SERISSIMA	AUTUMN WILLOW	G4	S2	PT	PT
SALIX X SUBSERICEA	MEADOW WILLOW	G5	S1	TU	PE
SAMOLUS PARVIFLORUS	PINELAND PIMPERNEL	G5	S2	TU	PE
SCHEUCHZERIA PALUSTRIS	POD-GRASS	G5	S1	PE	PE
SCHIZACHYRIUM SCOPARIUM VAR LITTORALE	SEASIDE BLUESTEM	G5T?	S3	PR	PR
SCHOENOPLECTUS ACUTUS	HARD-STEMMED BULRUSH	G5	S2	PE	PE
SCHOENOPLECTUS FLUVIATILIS	RIVER BULRUSH	G5	S3	PR	PR
SCHOENOPLECTUS HETEROCHAETUS	SLENDER BULRUSH	G5	SX	PX	PX
SCHOENOPLECTUS SMITHII	SMITH'S BULRUSH	G5?	S1	PE	PE
SCHOENOPLECTUS SUBTERMINALIS	WATER BULRUSH	G4G5	S3	N	PT
SCHOENOPLECTUS TORREYI	TORREY'S BULRUSH	G5?	S1	PE	PE
SCIRPUS ANCISTROCHAETUS	NORTHEASTERN BULRUSH	G3	S3	PE	PT
SCIRPUS PEDICELLATUS	STALKED BULRUSH	G4	S1	PT	PT
SCLERIA MINOR	MINOR NUTRUSH	G4	SH	PE	PE
SCLERIA MUEHLENBERGII	RETICULATED NUTRUSH	G5	S1	PE	PE

SCLERIA PAUCIFLORA	FEW FLOWERED NUTRUSH	G5	S2	PT	PT
SCLERIA TRIGLOMERATA	WHIP NUTRUSH	G5	SH	TU	TU
SCLERIA VERTICILLATA	WHORLED NUTRUSH	G5	S1	PE	PE
SCUTELLARIA SAXATILIS	ROCK SKULLCAP	G3	S1	TU	PE
SCUTELLARIA SERRATA	SHOWY SKULLCAP	G4G5	S1	PX	PE
SEDUM ROSEA	ROSEROOT STONECROP	G5	S1	PE	PE
SEDUM TELEPHIOIDES	ALLEGHENY STONECROP	G4	S3	PR	PR
SENECIO ANONYMUS	PLAIN RAGWORT	G5	S2	PR	PR
SENECIO ANTENNARIIFOLIUS	CAT'S-PAW RAGWORT	G4	S1	PE	PE
SENECIO PLATTENSIS	PRAIRIE RAGWORT	G5	SH	TU	PX
SENNA MARILANDICA	WILD SENNA	G5	S1	TU	PE
SHEPHERDIA CANADENSIS	CANADA BUFFALO-BERRY	G5	S1	PE	PE
SIDA HERMAPHRODITA	SIDA	G2	S2	PE	PE
SISYRINCHIUM ALBIDUM	BLUE-EYED GRASS	G5?	SH	TU	PX
SISYRINCHIUM ATLANTICUM	EASTERN BLUE-EYED GRASS	G5	S1	PE	PE
SISYRINCHIUM FUSCATUM	SAND BLUE-EYED GRASS	G5?	SH	PX	PX
SMILAX PSEUDOCHINA	LONG-STALKED GREENBRIER	G4G5	SH	PX	PX
SOLIDAGO ARGUTA VAR HARRISII	HARRIS' GOLDEN-ROD	G5T4	S1	PE	PE
SOLIDAGO CURTISII	CURTIS' GOLDEN-ROD	G4G5	S1	PE	PE
SOLIDAGO PURSHII	PURSH'S GOLDEN-ROD	G5	SH	TU	TU
SOLIDAGO RIGIDA	HARD-LEAVED GOLDENROD	G5	S1	TU	PE
SOLIDAGO ROANENSIS	TENESSEE GOLDEN-ROD	G4G5	S2	PR	PR
SOLIDAGO SIMPLEX SSP RANDII VAR RACEMOSA	STICKY GOLDEN-ROD	G5T4?	S1	PE	PE
SOLIDAGO SPECIOSA VAR ERECTA	SLENDER GOLDEN-ROD	G5	S1	PE	PE
SOLIDAGO SPECIOSA VAR SPECIOSA	SHOWY GOLDENROD	G5T5?	SR	N	PT
SOLIDAGO ULIGINOSA		G4G5	S3	N	TU
SORBUS DECORA	SHOWY MOUNTAIN-ASH	G4G5	S1	PE	PE

SPARGANIUM ANDROCLADUM	BRANCHING BUR-REED	G4G5	SH	PE	PE
SPARGANIUM ANGUSTIFOLIUM	BUR-REED	G5	S2	N	TU
SPARGANIUM MINIMUM	SMALL BUR-REED	G5	SX	PX	PX
SPIRAEA BETULIFOLIA	DWARF SPIRAEA	G4G5	S1	PT	PE
SPIRAEA VIRGINIANA	VIRGINIA SPIRAEA	G2	SX	PX	PX
SPIRANTHES CASEI	CASE'S LADIES'-TRESSES	G4	S1	PE	PE
SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES	G5	S3	N	TU
SPIRANTHES MAGNICAMPORUM	LADIES'-TRESSES	G4	SX	PX	PX
SPIRANTHES OVALIS	OCTOBER LADIES'-TRESSES	G5?	S1	PE	PE
SPIRANTHES ROMANZOFFIANA	HOODED LADIES'-TRESSES	G5	S1	PE	PE
SPIRANTHES TUBEROSA	LITTLE LADIES'-TRESSES	G5	S1	TU	PE
SPIRANTHES VERNALIS	SPRING LADIES'-TRESSES	G5	S1	PE	PE
SPIRODELA PUNCTATA	EASTERN WATER-FLAXSEED	G5	SH	TU	TU
SPOROBOLUS CLANDESTINUS	ROUGH DROPSEED	G5	S1	PE	PE
SPOROBOLUS HETEROLEPIS	PRAIRIE DROPSEED	G5	S1	PE	PE
STACHYS HYSSOPIFOLIA	HYSSOP HEDGE-NETTLE	G5	SH	TU	PX
STACHYS NUTTALLII	NUTTALL'S HEDGE-NETTLE	G5?	S1	PE	PE
STELLARIA BOREALIS	MOUNTAIN STARWORT	G5	S1S2	N	TU
STENANTHIUM GRAMINEUM	FEATHERBELLS	G4G5	S1S2	N	TU
STIPA SPARTEA	NEEDLE-GRASS	G5	SH	N	TU
STREPTOPUS AMPLEXIFOLIUS	WHITE TWISTED-STALK	G5	S1	PE	PE
STROPHOSTYLES UMBELLATA	WILD BEAN	G5	S2	N	PE
STYLOSANTHES BIFLORA	PENCILFLOWER	G5	S2	TU	PE
SWERTIA CAROLINIENSIS	AMERICAN COLUMBO	G5	S1	PE	PE
TAENIDIA MONTANA	MOUNTAIN PIMPERNEL	G4	S1	PE	PE
THALICTRUM CORIACEUM	THICK-LEAVED MEADOW-RUE	G4	S2	PE	PT
THALICTRUM DASYCARPUM	PURPLE MEADOW-RUE	G5	S1	N	TU
TIPULARIA DISCOLOR	CRANEFLY ORCHID	G4G5	S3	PR	PR

TOXICODENDRON RYDBERGII	GIANT POISON-IVY	G5	S1	N	PE
TRAUTVETTERIA CAROLINIENSIS	CAROLINA TASSEL-RUE	G5	S3	PR	PR
TRICHOSTEMA SETACEUM	BLUE-CURLS	G5	S1	PE	PE
TRIFOLIUM REFLEXUM	BUFFALO CLOVER	G5	SX	PX	PX
TRIFOLIUM VIRGINICUM	KATE'S MOUNTAIN CLOVER	G3	S1	PE	PE
TRIGLOCHIN PALUSTRE	MARSH ARROWGRASS	G5	SX	PX	PX
TRILLIUM CERNUUM		G5	S3	N	TU
TRILLIUM FLEXIPES	DECLINED TRILLIUM	G5	S2	TU	TU
TRILLIUM NIVALE	SNOW TRILLIUM	G4	S3	PR	PR
TRIOSTEUM ANGUSTIFOLIUM	HORSE-GENTIAN	G5	S1	TU	PE
TRIPHORA TRIANTHOPHORA	NODDING POGONIA	G3G4	SH	PE	PE
TRIPLASIS PURPUREA	PURPLE SANDGRASS	G4G5	S1	PE	PE
TRIPSACUM DACTYLOIDES	EASTERN GAMMA-GRASS	G5	S1	TU	PE
TRISETUM SPICATUM	NARROW FALSE OATS	G5	S1	N	PE
TROLLIUS LAXUS SENSU STRICTO		G3Q	S1	PE	PE
UTRICULARIA CORNUTA	HORNED BLADDERWORT	G5	S2	N	PT
UTRICULARIA GEMINISCAPA	BLADDERWORT	G4G5	S3	N	TU
UTRICULARIA INFLATA	FLOATING BLADDERWORT	G5	S1S2	N	TU
UTRICULARIA INTERMEDIA	FLAT-LEAVED BLADDERWORT	G5	S2	PT	PT
UTRICULARIA MINOR	LESSER BLADDERWORT	G5	S2S3	PT	PT
UTRICULARIA RADIATA	SMALL SWOLLEN BLADDERWORT	G4	SX	PE	PX
UTRICULARIA RESUPINATA	NORTHEASTERN BLADDERWORT	G4	SX	PX	PX
UTRICULARIA SUBULATA		G5	SX	N	PX
UVULARIA PUDICA	MOUNTAIN BELLWORT	G5	SH	TU	PR
VERNONIA GLAUCA	TAWNY IRONWEED	G5	S1	PE	PE
VERONICA CATENATA	PENNELL'S SPEEDWELL	G5	S1	TU	TU
VIBURNUM NUDUM	POSSUM-HAW	G5	S1	PE	PE
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	G5T5	S3S4	TU	PR
VIOLA APPALACHIENSIS	APPALACHIAN BLUE VIOLET	G3	S2	PT	TU
VIOLA BRITTONIANA	COAST VIOLET	G4G5	S1	PE	PE

VIOLA RENIFOLIA	KIDNEY-LEAVED WHITE VIOLET	G5	SH	TU	PX
VIOLA SELKIRKII	GREAT-SPURRED VIOLET	G5?	S1	N	TU
VIOLA TRIPARTITA	THREE-PARTED VIOLET	G5	SH	TU	PX
VITIS CINEREA VAR BAILEYANA	A PIGEON GRAPE	G4G5T?	SH	TU	PE
VITIS NOVAE-ANGLIAE	NEW ENGLAND GRAPE	G4G5Q	S1	PE	PE
VITIS RUPESTRIS	SAND GRAPE	G3	S1	PX	PE
VITTARIA APPALACHIANA	APPALACHIAN GAMETOPHYTE FERN	G4	S2	PT	PT
WOLFFIA BOREALIS	DOTTED WATER-MEAL	G5	S1	TU	TU
WOLFFIELLA GLADIATA	BOG-MAT	G5	S2	PR	PR
WOODWARDIA AREOLATA	NETTED CHAINFERN	G5	S2	N	PT
XYRIS MONTANA	NORTHERN YELLOW-EYED GRASS	G4	S3	PR	PR
XYRIS TORTA	TWISTED YELLOW-EYED GRASS	G5	S1	N	PT
ZIGADENUS GLAUCUS	WHITE CAMAS	G4G5	S1	N	PE
ZIZANIA AQUATICA	INDIAN WILD RICE	G5	S3	PR	PR

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Global Rank Definitions

Global ranks (i.e. range-wide conservation status ranks) are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network.

Basic Global Rank Codes and Definitions

GX **Presumed Extinct** - Believed to be extinct throughout its range. Not located despite intensive searches of historic sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

GH **Possibly Extinct** - Known from only historical occurrences. Still some hope of rediscovery.

G1 **Critically Imperiled** - Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or stream miles (<10).

G2 **Imperiled** - Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or stream miles (10 to 50).

G3 **Vulnerable** - Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

G4 **Apparently Secure** - Uncommon but not rare, and usually widespread. Possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.

G5 **Secure** - Common, typically widespread and abundant. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

Variant Global Ranks

G#G# **Range Rank** - A numeric range rank (e.g., G2G3) is used to indicate uncertainty about the exact status of a taxon.

GU **Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

G? **Unranked** - Global rank not yet assessed.

HYB **Hybrid** - Element represents an interspecific hybrid.

Rank Qualifiers

? **Inexact Numeric Rank** - Denotes inexact numeric rank.

Q **Questionable Taxonomy** - Taxonomic status is questionable; numeric rank may change with taxonomy.

C **Captive or Cultivated Only** - Taxon at present is extant only in captivity or cultivation, or as a reintroduced population not yet established.

Infraspecific Taxon Ranks

T **Infraspecific Taxon** (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species= basic rank (e.g.., a G1T2 subrank should not occur). A population (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T rank; in such cases a Q is used after the T rank to denote the taxon's questionable taxonomic status.

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State Rank Definitions

State Rank Codes and Definitions

SX **Extirpated** - Element is believed to be extirpated from the "state" (or province or other subnational unit).

SH **Historical** - Element occurred historically in the state (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an Element would become SH without such a 20-year delay if the only known occurrences in a state were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, SH-ranked Elements would typically receive an S1 rank. The SH rank should be reserved for Elements for which some effort has been made to relocate occurrences, rather than simply ranking all Elements not known from verified extant occurrences with this rank.

S1 **Critically Imperiled** - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer occurrences or very few remaining individuals or acres.

S2 **Imperiled** - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state.

Typically 6 to 20 occurrences or few remaining individuals or acres.

S3 **Vulnerable** - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences.

S4 **Apparently Secure** - Uncommon but not rare, and usually widespread in the state. Usually more than 100 occurrences.

S5 **Secure** - Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.

S? **Unranked** - State rank is not yet assessed.

SU **Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible, the most likely rank is assigned and a question mark added (e.g.., S2?) to express uncertainty, or a range rank (e.g.., S2S3) is used to delineate the limits (range) of uncertainty.

S#S# **Range Rank** - A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the Element. Ranges cannot skip more than one rank (e.g.., SU should be used rather than S1S4).

HYB **Hybrid** - Element represents an interspecific hybrid.

SE **Exotic** - An exotic established in the state; may be native in nearby regions (e.g.., house finch or catalpa in eastern U.S.).

SE# **Exotic Numeric** - An exotic established in the state that has been assigned a numeric rank to indicate its status, as with S1 through S5.

SA **Accidental** - Accidental or casual in the state (i.e., infrequent and outside usual range). Includes species (usually birds or butterflies) recorded once or only a few times. A few of these species may have bred on the one or two occasions they were recorded. Examples include European strays or western birds on the East Coast and vice-versa.

SZ **Zero Occurrences** - Not of practical conservation concern in the state because there are no definable occurrences, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long distance migrants whose occurrences during their migrations have little or no conservation value for the migrant as they are typically too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. In other words, the migrant regularly passes through the subnation, but enduring, mappable Element Occurrences cannot be defined. Typically, the SZ rank applies to a non-breeding population in the subnation -- for example, birds on migration. An SZ rank may in a few instances also apply to a breeding population, for example certain Lepidoptera which regularly die out every year with no significant return migration. Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration does not mean it receives an SZ rank. SZ only applies when the migrants occur in an irregular, transitory, and dispersed manner.

SP **Potential** - Potential that Element occurs in the state but no extant or historic occurrences reported.

SR **Reported** - Element reported in the state but without a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports.

SRF **Reported Falsely** - Element erroneously reported in the state (e.g., misidentified specimen) and the error has persisted in the literature.

SSYN **Synonym** - Element reported as occurring in the state, but state does not recognize the taxon; therefore the Element is not ranked by the state.

***** S rank has been assigned and is under review. Contact the individual state Natural Heritage program for assigned rank.

Not Provided Species is known to occur in this state. Contact the individual state Natural Heritage program for assigned rank.

Breeding Status Qualifiers

B **Breeding** - Basic rank refers to the breeding population of the Element in the state.

N **Non-breeding** - Basic rank refers to the non-breeding population of the Element in the state.

Note A breeding status subrank is only used for species that have distinct breeding and/or non-breeding populations in the state. A breeding-status SRANK can be coupled with its complementary non-breeding-status SRANK. The two are separated by a comma, with the higher-priority rank listed first in their pair (e.g.., AS2B,S3N@ or ASHN,S4S5B@).

Other Qualifiers

? **Inexact or Uncertain** - Denotes inexact or uncertain numeric rank. For SE denotes uncertainty of exotic status. (The ? qualifies the character immediately preceding it in the SRANK.)

C **Captive or Cultivated** - Element is presently extant in the state only in captivity or cultivation, or as a reintroduced population not yet established.

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Pennsylvania Status Definitions

Native Plant Species Legislative Authority: Title 17 Chapter 45, Conservation of Native Wild Plants, January 1, 1988; Pennsylvania Department of Conservation and Natural Resources.

Native Plant Status Codes and Definitions

PE **Pennsylvania Endangered** - Plant species which are in danger of extinction throughout most of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.

PT **Pennsylvania Threatened** - Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.

PR **Pennsylvania Rare** - Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.

Disjunct Significantly separated from their main area of distribution

Endemic Confined to a specialized habitat.

Limit of Range At or near the periphery of their natural distribution

Restricted Found in specialized habitats or habitats infrequent in Pennsylvania.

PX **Pennsylvania Extirpated** - Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.

PV **Pennsylvania Vulnerable** - Plant species which are in danger of population decline within Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.

TU **Tentatively Undetermined** - A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxanomic uncertainties, limited evidence within historical records, or insufficient data.

N No current legal status exists, but is under review for future listing.

Wild Birds and Mammals Legislative Authority: Title 34 Chapter 133, Game and Wildlife Code, revised Dec. 1, 1990, Pennsylvania Game Commission.

Wild Birds and Mammals Status Codes and Definitions

PE **Pennsylvania Endangered** - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended.

PT **Pennsylvania Threatened** - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

N No current legal status but is under review for future listing.

Fish, Amphibians, Reptiles, and Aquatic Organisms Legislative Authority: Title 30, Chapter 75, Fish and Boat Code, revised February 9, 1991; Pennsylvania Fish Commission.

Fish, Amphibians, Reptiles, and Aquatic Organisms Status Codes and Definitions

PE **Pennsylvania Endangered** - All species declared by: 1) the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission, Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.

PT **Pennsylvania Threatened** - All species declared by: 1) the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

PC Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.

N No current legal status, but is under review for future listing.

Invertebrates Legislative Authority: No state agency has been assigned to develop regulations to protect terrestrial invertebrates although a federal status may exist for some species. Aquatic invertebrates are regulated by the Pennsylvania Fish Commission but have not been listed to date.

Invertebrates Status Codes and Definitions

N No current legal status but is under review for future listing.

Pennsylvania Biological Survey (PBS) Suggested Status Definitions

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Pennsylvania Biological Survey (PBS) Suggested Status Codes and Definitions

Note: the same PBS Status codes and definitions are used for all PNDI tracked species.

PE **Pennsylvania Endangered** - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended.

PT **Pennsylvania Threatened** - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

PR **Pennsylvania Rare** - Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.

Disjunct Significantly separated from their main area of distribution

Endemic Confined to a specialized habitat.

Limit of Range At or near the periphery of their natural distribution

Restricted Found in specialized habitats or habitats infrequent in Pennsylvania.

CP **Candidate Proposed** - Species comprising taxa for which the Pennsylvania Biological Survey (PBS) currently has substantial information on hand to support the biological appropriateness of proposing to list as Endangered or Threatened.

CA **Candidate at Risk** - Species that although relatively abundant now are particularly vulnerable to certain types of exploitation or environmental modification.

CR **Candidate Rare** - Species which exist only in one of a few restricted geographic areas or habitats within Pennsylvania, or they occur in low numbers over a relatively broad area of the Commonwealth.

CU **Condition Undetermined** - Species for which there is insufficient data available to provide an adequate basis for their assignment to other classes or categories.

PX **Pennsylvania Extirpated** - Species that have disappeared from Pennsylvania since 1600 but still exist elsewhere.

DL **Delisted** - Species which were once listed but are now cited for delisting.

N No current legal status, but is under study for future listing.

Federal Status Definitions

Native Plant and Animal Species Legislative Authority: United States Endangered Species Act of 1973: Public Law 93-205. U.S. Fish and Wildlife Service.

Federal Status Codes and Definitions

LE	**Listed Endangered** - A species which is in danger of extinction throughout all or a significant portion of its range.
LT	**Listed Threatened** - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
LELT	Listed **Endangered** in part of range; listed **Threatened** in the remaining part.
PE	**Proposed Endangered** - Taxa proposed to be listed as endangered.
PT	**Proposed Threatened** - Taxa proposed to be listed as threatened.
PEPT	Proposed **Endangered** in part of range; proposed **Threatened** in the remaining part.
C	**Candidate** for listing.
E(S/A)	Treat as **Endangered** because of similarity of appearance.
T(S/A)	Treat as **Threatened** because of similarity of appearance.
XE	Essential **Experimental** population.
XN	Nonessential **Experimental** population.
"xy" (mixed status)	Status varies for different populations or parts of range.
"x" NL	Status varies for different populations or parts of range with at least one part not listed.
